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# METALS and ALLOYS

## The Magazine of Metallurgical Engineering

**PRODUCTION • FABRICATION • TREATMENT • APPLICATION**

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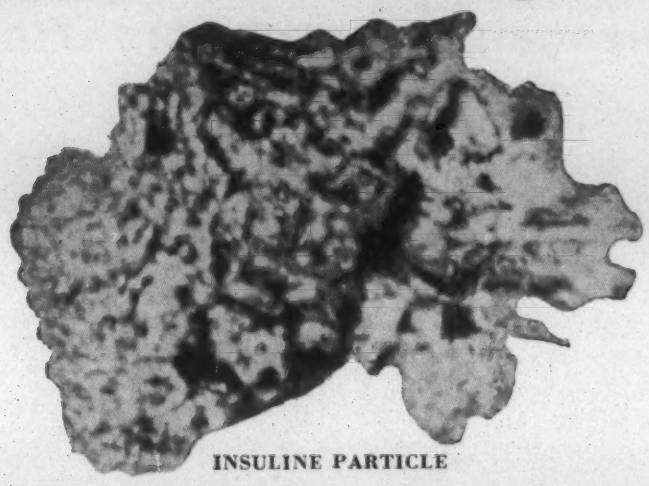
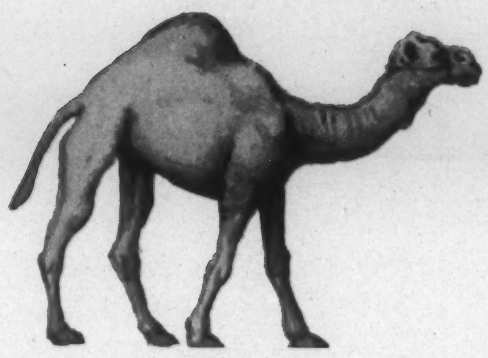
# INSULINE

(REG. U. S. PAT. OFF. PATENTS PENDING)

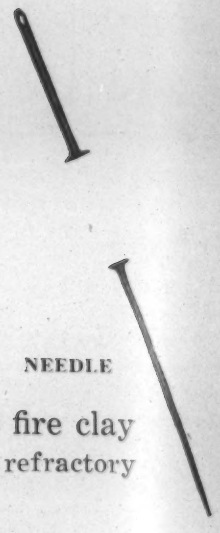
## CAN but the camel CAN'T pass through the needle's eye



INSULINE PARTICLE



CAMEL



NEEDLE

Pictured above is an INSULINE Particle magnified 2100 times. Its stable, calcined fire clay base——with thin-walled, minute, cellular structure——produces the light weight, low heat storage, refractory and insulating properties of INSULINE Products described below.

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(REG. U. S. PAT. OFF.)

INSULBRIX are light-weight cellular low heat storage insulating fire brick for direct or indirect exposure to flame and furnace gases in boiler and other furnaces, ovens, and kilns.

INSULBRIX are made in several brands from one-tenth to one-seventeenth the heat storage capacity of heavy refractories; 1″ has an insulating value of 3″ to 5″ of fire brick; permit heated equipment to: reach operating conditions in less time; meet fluctuations more rapidly.

Result in: increased output; conservation of fuel; decreased labor costs; improved furnace room conditions; greater comfort to the workmen.

## INSULCRETE

(REG. U. S. PAT. OFF.)

INSULCRETE is a light-weight cellular insulating refractory concrete for furnace linings, door linings, heat shields, shapes, covers, and kindred uses; recommended for temperatures up to 2500°F. No cutting, fitting or ramming—**just pour into place.**

1″ of INSULCRETE equals about 4″ of fire brick in insulating value and has about one-seventh the heat storage capacity of fire brick walls of equal heat flow.

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It is quickly and easily applied by molding, troweling or Quigley Refractory Gun wherever plastic insulation is required. 1″ of INSULAG has an insulating value equal to about 9″ of fire brick and has about one-fortieth the heat storage capacity of fire brick walls of equal heat flow.

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INSULBLOX are superior refractory block insulation used for direct exposure up to 2000°F. and for indirect at 2200°F. They permit the use of insulation closer to the fire. INSULBLOX, because of their calcined stable fire clay base stand severe service. Do not lose their insulating properties nor shrink from the brickwork where properly used.

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# Highlights

**WRITTEN BY THE ABSTRACT SECTION EDITORS AND THE EDITORIAL STAFF**

*Do you want to know what metallurgical engineers are saying, the world over? Look in the Current Metallurgical Abstracts. Here are some of the points covered by authors whose articles are abstracted in this issue.*

---

### Carbonyl Iron

Iron free from S and P can be made by allowing iron carbonyl to decompose, the powdered iron thus formed can be stuck together by sintering, and may be carburized to give Fe-C alloys which can be wrought like steel. Melting of such alloys will give cast material also free from S and P. An extended study of the alloys by Offerman (page MA 172 L 4), leads to the comforting conclusion that, broadly speaking, these purer alloys are not better than everyday steel with appreciable quantities of S and P. —H.W.G.

### Cast Iron Bearings

Tobias and Mannheim (page MA 172 L 8) argue that pearlitic cast iron is superior to bronze for bearings. That's a sweeping statement, doubtless true for some conditions, quite untrue for others. What the factors are that make it true or untrue would fill a book, which we'd like to have written if only some author could be found who knows all the factors in the design and application of bearings and lubricants. Our hunch is the book hasn't been written because nobody yet knows enough to write it. —H.W.G.

### Magnetic Magnesium Alloys

Haughton & Schofield (page MA 166 L 4) report that some of the Mg-rich Mg-Ce alloys studied by them were feebly magnetic.—F.P.P.

### No Inhibitors Needed for 18-8?

The statement, attributed to Snelling and Richards (page MA 159 L 4) that "austenitic steels containing 16-18% Cr and 8% Ni need no inhibitors" during pickling requires some qualification. Pickling of these steels in inhibitor-free sulphuric or hydrochloric acid solutions is truly slow—in fact it usually is *too slow* for economical operation. However, the addition of even small amounts of nitric acid speeds the reaction so much that control becomes difficult and an inhibitor, if one existed that was not rapidly destroyed by the $HNO_2$, would most certainly be used. The problem, made doubly serious by the expensive nature of the 18-8 steels, aches for solution.—F.P.P.

### Pure Zinc

You'd think that any old-zinc would do for use in contact with buried pipe lines, to offer galvanic protection by its sacrificial action, just as we are not fussy about the purity of zinc for hot-galvanizing. On the contrary, Rhodes (page MA 174 L 4) says that less than 0.01% of Pb and Cd can be tolerated.—H.W.G.

### Good Work, Ethyl

Credit to Ethyl Gasoline Corp. for describing a slushing compound whose actual composition is stated, instead of being hidden behind some euphonious trade name (page MA 174 R 8).—H.W.G.

### Painted Steel

Too little is known about the corrosion-resistance of painted steel, so English work (page MA 174 L 8) is welcome. The conclusion that of two steels, the one more resistant to atmospheric corrosion when bare is likewise the more resistant when painted, sounds reasonable. But corrosion plays such funny tricks that even an axiomatic assumption needs experimental corroboration before it has unqualified acceptance.—H.W.G.

### Cast Iron and Corrosion

Hudson (page MA 174 R 6) suggests that the corrosion resistance of cast iron is partly due to a graphite-free, very thin surface layer, which should not be removed. Sounds like the "micro-chill" that has been discussed in connection with cast iron for enameling. Apparently one shouldn't sand-blast his castings if he wants to preserve the layer.—H.W.G.

### Tin in Torrington

Yes, but it's the New South Wales (page MA 132 L 2), not the Connecticut one.—H.W.G.

### Puzzling

If you use sulphate in a chromium plating bath it is not allowable to leave all the sulphate out, but if you use fluoride in it instead of sulphate, it is allowable to leave all the fluoride out (page MA 160 L 8). Reminds us of the old Electro-chemical Soc. song that ended—"He spit in some tobacco juice, and then he added beer, And now Johnny knows why it plated out so queer." —H.W.G.

### No Hope!

Corson (page MA 177 L 5) says there's little chance of new Cu-base alloys being developed with more desirable characteristics than the present ones. Mebbe so, but didn't a Patent Office examiner resign many years ago because everything had already been invented?—H.W.G.

### It Can't Be Done

So say three Russians (page MA 166 L 2) in reference to graphitization of steel with less than 0.80% C. They should read Kinzel & Moore, A.I.M.E. Tech. Pub. 565, who reported on complete graphitization of a 0.15% C oil still tube in service 3 yrs. Perhaps 3 yr. tests don't fit into the 5 yr. plan.—H.W.G.

### Is There an Increase in Interest in Nitriding?

The Nitriding Symposium held in Cleveland in 1929 under the auspices of the A.S.S.T. (now A.S.M.) doubtless marked the peak in interest in this method of surface hardening of steel parts. In line with the usual cycle of new developments, there were some uses of nitrided materials which failed to give satisfactory service. This alone detracted from increased use of the process. Then there was the depression with consequent efforts to eliminate costly processes. With conditions changed somewhat and the nitriding process better understood, both as to advantages and limitations, one may speculate as to renewed interest and use of this process. Nitriding furnaces in an automotive plant are described by J. B. Nealey (page MA 142 L 2); gray iron case hardened by beryllium is compared with nitrided steels by Laissus (page MA 142 R 4); the nitriding of alloy tool steels is discussed by Homerberg (page MA 146 R 5); studies on the mechanism of nitriding steels are reported by Schechter (page MA 146 R 6); electrically heated nitriding furnaces are described by Zerpuer (page MA 146 R 7) and Ormont and Petrow have reported on thermal dissociation studies involving Fe-N compounds (page MA 146 R 9).—O.E.H.

### Carburization and Decarburization

Metallurgists and practical heat treaters are always interested in loss or gain of carbon in the heat treating operation. Doehlemaun (page MA 142 R 7) has studied the velocities of carburization and decarburization of Fe, Ni and Co in $CO$-$CO_2$ mixtures at 920-970 deg. C. and drawn some interesting conclusions.—O.E.H.

### Inhibitors

Inhibitors for use in pickling and for corrosion prevention come in for a lot of discussion in this month's abstracts (pages MA 159 L 6, R 2; MA 160 R 1 and MA 174 R 3) and several quite different theories of their action are advanced.—H.W.G.

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# EDITORIAL

## Strategic Materials and War

*In further reference to our editorial comment in the February issue on "Manganese—A Strategic Material," the following remarks are pertinent:*

The Editor of *Aviation,* in the January issue of that journal, describes a European trip he made in the fall of '36 to visit aircraft factories. His story of the feverish activity in building bombers and other military planes is an eye opener as to how far war preparations are going on, especially in Germany, with Russia and Italy evidently working at a similar pace. These three countries, together with France and England, now have, he says, some 25,000 military planes and, at present rate of production, this will be doubled by the fall of '37.

The Junkers works alone has over 25,000 employees. (As a basis of comparison, this is more than all the employees at all the plants of the Aluminum Co. of America.) The building of the Air Ministry in Berlin has 2,500 offices; the number of people per office is not stated. He says that all that is necessary for a war to be started is to have someone in one of these offices press a button; no Congress will debate the matter.

All this preparation is due to the belief that the advantage in the next war goes to him who attacks first, the attack probably being on the enemy's aircraft plants.

This idea as to "sudden attack on the unsuspecting enemy" by aircraft is echoed in an apparently official German propaganda sheet entitled "News in Brief," published in English. The Dec. 10 issue alleges that Russia is having air bases erected in Czechoslovakia from which Berlin could be reached in 42 minutes, quite directly implying that Russia expects to attack Berlin and that Czechoslovakia connives.

The propaganda sheet throws many other sidelights on the way a dictator operates. In expositions of the "reform" of the German Criminal Code and of "the problems of administrative law" it is brought out that "the will to serve the body politic points out to the judge the way his course lies." The law is liberated from "external barriers" and the judge "metes out punishment also according to unwritten law." This comes a few paragraphs after mentioning heavy penaltics for "slandering" the Führer as Chancellor, leader of the party, or as individual, or "defaming" the National Socialistic Party. "The National Socialistic State does not restrict itself to confining administration to mere legal formalities. Administration always served a philosophy and is adapted to the very last ramification according to the policy of the government. The actions of the Government and the measures of the highest authorities of the Reich must be beyond all dispute, for political leadership must not be hampered in the pursuit of its political aims."

Thus baldly is it brought out that only the whim of the dictator counts. Of course, this is only carrying to a logical conclusion the ideas being expressed in the United States in favor of throwing away the checks and balances provided by the Supreme Court, but those who favor that step might well read this Dec. 10 issue of "News in Brief."

Other choice bits in the issue tell us that any German citizen who removes his property abroad will be punished with the *death penalty.* Raising of prices is prohibited. "Any disregard of this decree will be punished by prison and fine, the latter to an *unlimited extent.*" "The German press, which four years ago was in the service of international destructive ideas or uncontrollable anonymous interests of the big capitalists, in Jewish hands and appealing to the stupidity of the masses, represents again today German aims as revealed by German pens and is utilized for the representation of our national ideals." ("Stupidity of the masses" is doubtless a correct phrase when they stand what they do from a dictator.)

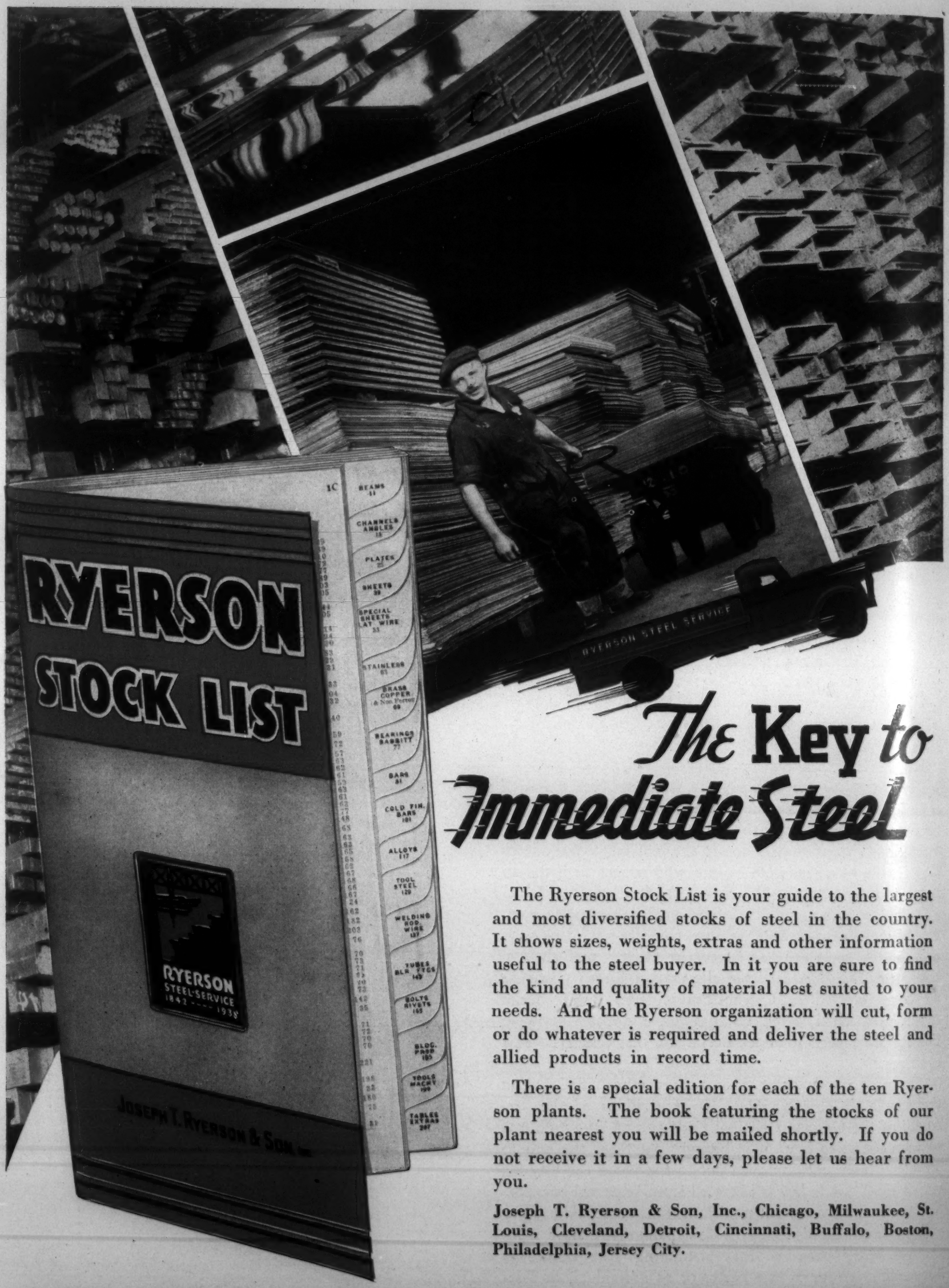
In regard to education—"all students in their first, second and third terms will in future be subject to political education through the NSDStB." As to research—"German Wissenschaft is placed under the protection of the National Socialistic State and not under the protection of private circles. Every great research achievement gains its life only from its connection with the necessities of the nation as such."

Dropping from the sublime to the ridiculous, to all this censorship and regimentation is added—no more art criticism is to be allowed, the "art critic" will be replaced by an "art editor," and future art editors must be at least 30 years old. Nothing seems too trivial for some third assistant dictator to regulate, with punishment for violation also adaptable to whim.

Under such conditions, paralleled in the other dictator-ridden countries, it only takes some little spark to start the fuse and that to start others, like a pack of firecrackers. "News in Brief" quotes Stalin that modern war will not be declared, but made.

So when foreign demand for scrap steel and for copper shoots prices abroad up so high that American prices have to follow to prevent robbing the United States of its own supplies and keep our materials at home, metallurgists have clearly brought home to them how far this war craziness has gone on the Continent.

We might well prepare for the situation that even far-away neutrals are likely to find themselves in at any moment.—H. W. G.

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# CURRENT Metallurgical Abstracts

## A DIGEST OF THE IMPORTANT METALLURGICAL DEVELOPMENTS OF THE WORLD


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## CLASSIFICATIONS

### 1. ORE CONCENTRATION

*Crushing, Grinding & Plant Handling (1a), Gravity Concentration (1b), Flotation (1c), Magnetic Separation (1d), Amalgamation, Cyanidation & Leaching (1e).*

### 2. ORE REDUCTION

*Non-Ferrous (2a), Ferrous (2b).*

### 3. MELTING, REFINING AND CASTING

*Non-Ferrous (3a), Ferrous (3b).*

### 4. WORKING

*Rolling (4a), Forging & Extruding (4b), Cold Working, including Shearing, Punching, Drawing & Stamping (4c), Machining (4d).*

### 5. HEAT TREATMENT

*Annealing (5a), Hardening, Quenching & Drawing (5b), Aging (5c), Malleableizing (5d), Carburizing (5e), Nitriding (5f).*

### 6. FURNACES, REFRACTORIES AND FUELS

### 7. JOINING

*Soldering & Brazing (7a), Welding & Cutting (7b), Riveting (7c).*

### 8. FINISHING

*Pickling (8a), Cleaning, including Sand Blasting (8b), Polishing & Grinding (8c), Electroplating (8d), Metallic Coatings other than Electroplating (8e), Non-Metallic Coatings (8f).*

### 9. TESTING

*Inspection & Defects, including X-Ray Inspection (9a), Physical & Mechanical Testing (9b), Fatigue Testing (9c), Magnetic Testing (9d), Spectrography (9e).*

### 10. METALLOGRAPHY

### 11. PROPERTIES OF METALS AND ALLOYS

*Non-Ferrous (11a), Ferrous (11b).*

### 12. EFFECT OF TEMPERATURE ON METALS AND ALLOYS

### 13. CORROSION AND WEAR

### 14. APPLICATION OF METALS AND ALLOYS

*Non-Ferrous (14a), Ferrous (14b).*

### 15. GENERAL

*Economic (15a), Historical (15b).*

# 1. ORE CONCENTRATION

JOHN ATTWOOD, SECTION EDITOR

**The Torrington Tinfield.** M. R. McKeown. *Chemical Engineering & Mining Review,* Vol. 28, Sept. 8, 1936, pages 425-430. Large tonnages of Sn, wolframite, and Bi ores have been produced from the Torrington, N.S.W. district. The milling practice at Curnow's mill is described and a flowsheet of the treatment plant shown. WHB (1)

**Milling at Sullivan Consolidated Mines, Ltd.** W. M. McLellan. *Canadian Mining Journal,* Vol. 57, Oct. 1936, pages 540-543. Crushing, grinding, blankets, cyanidation, precipitation, refining and amalgamation, with operating data are briefly covered. WHB (1)

**Is Flotation the Last Word in Milling Practice?** R. S. Handy. *Mining Congress Journal,* Vol. 22, Oct. 1936, pages 53-55. A comparison of gravity concentration and flotation. The author looks for future trends to swing away somewhat from flotations as a panacea for all ills of ore dressing, toward gravity methods where conditions are favorable for the latter. In treating oxide ore and other ores not amenable to concentration by flotation the deflocculation and desliming of finely divided portions of the pulp permit distinctly high recoveries with high-grade products to be made by gravity treatment with standard equipment; only simple changes are necessary to adapt them to the requirement. BHS (1)

**Peru's Gold-Mining Industry Grows—New Mills Number Six, with Two More Under Consideration.** C. Carleton Semple. *Engineering & Mining Journal,* Vol. 137, Dec. 1936, pages 609-612. WHB (1)

**Mining at Shawkey Gold Mines.** F. Leaman. *Canadian Mining Journal,* Vol. 57, Oct. 1936, pages 544-545. WHB (1)

**Mining Operations at the Greene Stabell Mine.** *Canadian Mining Journal,* Vol. 57, Oct. 1936, pages 549-550. WHB (1)

**Milling Practice at Greene Stabell Mines, Ltd.** *Canadian Mining Journal,* Vol. 57, Oct. 1936, pages 551-552. WHB (1)

**The Geology of Lamaque Mine.** H. S. Wilson. *Canadian Mining Journal,* Vol. 57, Oct. 1936, pages 511-516. A review of the property of Lamaque Gold Mines, Ltd WHB (1)

**Mining Methods at Sullivan Consolidated Mines, Ltd.** H. F. Taylor. *Canadian Mining Journal,* Vol. 57, Oct. 1936, pages 538-539. WHB (1)

**Victoria's Gold Mines. I. Bedminyong Rand, Wattle Gully and Gordon.** L. A. Crozier. *Chemical Engineering & Mining Review,* Vol. 29, Oct. 8, 1936, pages 17-23. The first of a series of articles describing Victoria's smaller Au mines and discussing briefly operations at these mines. WHB (1)

## 1c. Flotation

**An Old Mine Rewards New Investment.** Gail Martin. *Engineering & Mining Journal,* Vol. 137, Nov. 1936, pages 555-556. The Elkoro Au-Ag property reopened at Jarbidge, Nev., reveals large tonnages of pay ore. The flotation flowsheet of the 250 ton concentrator is shown. WHB (1c)

**The Effect of Hydrogen Ion Concentration and added Chemicals on the Flotation of Enargite.** Gaichi Yamada and Susumu Koizumi. *Suiyokwai-Shi,* Vol. 9, Nov. 1936, pages 89-94. In Japanese. Experiments with Kingaseki enargite from Formosa showed that the floatability of enargite is about 90% in solutions of pH less than 6 and becomes less than 10% in solutions of pH greater than 6. In the presence of 100 g. $CuSO_4 \cdot 5H_2O$ or $ZnSO_4 \cdot 7H_2O$/ton of ore the floatability stays between 90 and 95% in acid solution; with the Zn salt it drops to 50% in basic solutions. In the presence of KCN, floatability decreases in steps from 95 to 0% over the pH range 0.5 to 11. Tannin floats 90% of enargite in solutions of pH lower than 6 and less than 20% in solutions of pH higher than 6. NaCl cannot be used. 440 g. of camphor white oil/ton of ore were used in each experiment. HN (1c)

**The Effect of Hydrogen Ion Concentration and added Chemicals on the Flotation of Arsenopyrite.** Gaichi Yamada & Onzo Jyo. *Suiyokwai-Shi,* Vol. 9, Nov. 1936, pages 83-88. In Japanese. Koyo arsenopyrite from Korea was ground to pass 65 mesh and that which passed 250 mesh was removed. Flotation experiments with this arsenopyrite in solutions of various pH concentrations with camphor white oil, K ethyl xanthate, and a small amount of chemical, e.g., $CuSO_4 \cdot 5H_2O$, KCN, $ZnSO_4 \cdot 7H_2O$, NaCl or tannin, $Na_2So_3 \cdot 7H_2O$ were performed. With no added reagents, solutions of pH 3-9.5 before flotation, showed pH values of about 7 after flotation. The floatability of arsenopyrite (with no added chemicals) is from 86-88% in solutions of pH lower than 5, and it drops suddenly to 0% in solutions of pH greater than 5. Although $CuSO_4 \cdot 5H_2O$ and $Na_2SO_3 \cdot 7H_2O$ activate arsenopyrite, the flotation experiments showed that the addition of 100 g. Cu salt/ton of ore failed to prevent the reduction in floatability of arsenopyrite from 88 to 0% when pH becomes greater than 5, and the addition of 100 g. $Na_2SO_3 \cdot 7H_2O$, KCN or $Zn\ So_4 \cdot 7H_2O$/ton of ore was also without effect. In 3.5% NaCl solution arsenopyrite does not float at all when the pH exceeds 5.5. HN (1c)

**Contact Angle and Floatability (Über Randwinkel und Schwimmvermögen)** S. Valentiner. *Metall und Erz,* Vol. 33, May 1, 1936, pages 221-226. A theoretical and experimental investigation of the conclusions of Eschenbach, Petersen and Pöppefle relative to floatability and the contact angle is performed. The 3 available methods of measuring contact angle are shown to give different results. The appearance of a hysteresis effect complicates the experimental establishing of a contact angle-floatability relationship. Under properly controlled conditions, a definite relationship between the contact angle and the floatability can be determined, contrary to the previous authors' conclusion that none exists. FPP (1c)

## 1e. Amalgamation, Cyanidation & Leaching

**The Cyanidation Mill of Lamaque Gold Mines, Limited.** W. H. Zieman. *Canadian Mining Journal,* Vol. 57, Oct. 1936, pages 524-537. An illustrated description. WHB (1e)

**Review of the Possibilities of Recovering Gold from the Austrian Gold Deposits (Uberblick über die Ausbeutungsmöglichkeiten der österreichischen Goldvorkommen)** Lukas Waagen. *Montanistische Rundschau,* Vol. 28, Dec. 1, 1936, 4 pages. Two plants are in operation at the present time: Rathausberg, with estimated ore reserves of 30,000,000 tons, containing about ⅓ oz. of Au per ton, and Carinthia, with only about 70,000 tons of visible reserves, of about the same Au content. Several other deposits are known, but are not in operation. Present metallurgical methods are inefficient, capable of a recovery of only 65%. However, with flotation and other modern treatment methods, it is possible to raise the recovery to over 90%, according to large scale tests. The possibilities of extending this industry are therefore promising. BHS (1e)

**Recent Trends in Cyanide Milling Equipment.** E. H. Bronson. *Canadian Mining Journal,* Vol. 57, Dec. 1936, pages 636-638. A review of personal observations in various mills of Northern Ontario. WHB (1e)

**Experiments on the Cause of Bubble Attachment in Flotation.** Osborn Cutler Shepard. *Mining & Metallurgy,* Vol. 17, July 1936, page 339. See "Electro-capillary Amalgamation," *Metals and Alloys,* Vol. 7, July 1936, page MA 339L/8. VSP (1e)

**Mining and Milling Methods and Costs at the Yellow Aster Mine, Randsburg, Calif.** Corwin L. Cooper. *United States Bureau of Mines, Information Circular,* No. 6900, Aug. 1936, 21 pages. Au ore from the mine is stamp milled (185 tons/day) and amalgamated. Tailings from the mill and impounded tails are cyanided (1100 tons/day). Total costs of mining and milling are $0.3293/ton of ore, of which $0.0672 is for mining. Reagent consumption/ton of dry solids is cyanide 0.180, CaO 2.70, and Zn dust 0.076 lb. AHE (1e)

# 2. ORE REDUCTION

A. H. EMERY, SECTION EDITOR

Reactions in the Solid State II. Investigation of the Formation of Copper-Ferrite According to Hahn's Emanation Method (Reaktionen im festen Zustand II. Eine Untersuchung der Bildung von Kupferferrit nach der Hahnschen Emaniermethode) R. JAGITSCH & A. MASCHIN. *Sitzungsberichte der Akademie der Wissenschaften in Wien, Mathematisch-Naturwissenschaftliche Klasse, Abt. II b, Chemie,* Vol. 145, No. 4, 1936, pages 321-328. The reaction of $Fe_2O_3$ and CuO was studied with and without the addition of RdTh and the data were plotted in various ways. WH (2)

## 2a. Non-Ferrous

**Alumina from Bauxite.** R. SEIDEN. *Chemical Trade Journal & Chemical Engineer,* Vol. 99, Aug. 21, 1936, page 144. Describes Müller-Hiller modification of the Bayer process. Principal change is substitution of a continuous pressure plant for decomposition of the bauxite with alkali for the intermittent Bayer decomposition in high capacity autoclaves. With the exception of the decomposition plant, the whole of the equipment used in the ordinary Bayer process can be used. There is a saving of over 50% in heat requirements and over $4 per ton of calcined $Al_2O_3$. The modified method can be applied satisfactorily to varieties of bauxite, unsatisfactory for standard Bayer methods. MS (2a)

**Alumina from Bauxite.** VEREINIGTE ALUMINIUM-WERKE A.-G. *Chemical Trade Journal & Chemical Engineer,* Vol. 99, Sept. 11, 1936, page 210. Abstract of British patent 451,090 for continuous extraction of $Al_2O_3$ from bauxite in towers by the flow of hot aluminate liquor under pressure. MS (2a)

**A Static Method for Determination of Equilibria of Metals with Carbon Dioxide.** A. F. KAPUSTINSKY & ANNA SILBERMAN. *Acta Physicochimica USSR,* Vol. 4, No. 4, 1936, pages 436-504. In English. On the basis of Deville's principle, a method has been elaborated for measuring the equilibrium of reactions of the type

$$Me + CO_2 \rightleftarrows MeO + CO$$

The method is based on maintaining one of the components of the gaseous mixture at constant pressure by producing its solid phase. An apparatus has been designed in which a constant $CO_2$ pressure is maintained and the total pressure of the gas phase is determined with a pressure gauge. The equilibrium

$$Sn + 2CO_2 \rightleftarrows SnO_2 + 2CO$$

has been studied taking into account the factor of thermal diffusion. The free energy and heat content of the components of the reaction, the dissociation constant of cassiterite and the constant of the equilibrium

$$2SnO_2 + 3C \rightleftarrows 2Sn + CO_2 + 2CO$$

were calculated. The experimental results and a thermodynamic calculation indicate the usefulness of the testing method for sufficiently accurate determination of the equilibria of metal oxides with CO. EF (2a)

**On the Development of Thermal Zinc Reduction and Purification I-VII (Zur Entwicklung der Thermischen Zinkgewinnung u. Zinkreinigung I-VII)** W. LEITGEBEL. *Metallwirtschaft,* Vol. 15, Oct. 9, 1936, pages 955-960; Nov. 13, 1936, pages 1088-1091; Nov. 27, 1936, pages 1148-1150. The equilibria involved in the reduction of ZnO with C, CO, $CH_4$ and $H_2$ are reviewed and applied to practical ore reduction. Methods of improving heat transfer by furnace design and mixing of reactants, means for establishing advantageous gas ratios and the newer vertical retorts are described. Chapters on the condensation of Zn vapor and the fractional condensation and distillation of Pb, Zn, and Cd vapors are included. GD & GA (2a)

**Present State of Vanadium Problem in Russia.** M. N. SOBOLEV. *Kachestvennaia Stal,* Vol. 4, No. 8-9, 1936, pages 39-41. Russia has no deposits of rich V ores, but much Fe ore containing up to 0.5% V. When this ore is smelted in blast furnaces, 80% V passes into metal. This is removed by the slag during steel making. V is removed from this slag by chemical means, which are described. (2a)

## 2b. Ferrous

2 **System of Blast Furnace Charging.** A. J. BOYNTON. *Blast Furnace & Steel Plant,* Vol. 24, July 1936, pages 603-606. Discusses certain conditions of blast furnace charging and operation, and describes improved method of charging and apparatus therefor. Coke is screened into 2 sizes. Larger size is charged with ore and limestone so that it rests within annulus corresponding to area covered by ore. Smaller size is charged so that it comes to rest within inner circle of the top. Size of coke so placed should be small enough to produce desired reduction in amount of gas passed, but large enough to permit passage of an adequate supply 3 of gas to heat central column. Use of this system will make feasible increase of stock-line diam., with reduction in velocity of gases through top and of flue-dust, avoidance of many of the complications now necessary in gas washing, and increased economy in use of fuel. MS (2b)

4 **Direct-Flow Blast Furnace Tuyere is Built with Double Compartment.** *Steel,* Vol. 99, Aug. 3, 1936, page 43. Tuyere is cast with rims around interior walls at suitable distance from nose. Series of plates are cast as segments integral with exterior rim. Plates project upward to facilitate removal of sand core but later are hammered down onto upper face of interior rim, dividing tuyere into 2 separate compartments. Inlet $H_2O$ is delivered to lower compartment where it circulates around nose and is then reflected to main compartment by a vertical baffle cast integral with tuyere. Metal baffle plates are cast from exterior wall of 5 tuyere to assist in cooling. Bubbles formed on interior surface of tuyere are eliminated immediately. Tuyeres are hammered on nose to increase density and to afford a smoother and harder surface. MS (2b)

6 **The Effect of the Nature of Intermediary Phases on the Rate of Reduction of Iron Oxides by Hydrogen (Ueber den Einfluss der Form der sich bildenden Zwischenphasen auf die Geschwindigkeit der Reduktion von Eisenoxyden durch Wasserstoff)** G. TSCHUFAROFF & B. AWERBUCH. *Acta Physicochimica USSR,* Vol. 4, No. 4, 1936, pages 617-634. In German. The reaction speed of the reduction of natural crystalline magnetite and hematite by H at 300-700° C. (20° intervals) was studied. The ultra- and microporosity of the solid phase during the reduction as well as the nature and composition of the intermediary phases were also investigated. The solid solution of individual components in each other could not be found. EF (2b)

**Reduction of Iron Ores with Solid Carbon. A Stathmographic Investigation.** A. E. DOBNER & ST. SKRAMOVSKY. *Iron & Coal Trades Review,* Vol. 133, Oct. 2, 1936, page 576. The reduction of Fe ores by solid C was investigated with a stathmograph, an instrument that records graphically the loss of weight during the reduction. Ha (2b)

8 **Pig Iron from Pyrite Clinker.** FEDERICO GIOLITTI. *Metal Progress,* Vol. 30, Nov. 1936, pages 55, 96. Describes the electric reduction of pyrite clinker to pig Fe using coke as the reducing agent. WLC (2b)

9 **A Study of a Direct Method of Stainless Steel Production.** R. P. FORSYTH. *Journal Chemical, Metallurgical & Mining Society South Africa,* Vol. 36, May 1936, pages 319-338 (1936).—The Hamilton-Evans process for production of a low-C stainless steel, the Cr being derived by reduction of chromite by ferro-silicon above a prepared bath of low-C steel, is discussed at length. Its success depends on the receptor slag composition; this slag should be as low in bulk as possible, as basic as possible, at least 20% MgO, as high in $Al_2O_3$ as $SiO_2$, at least 6% $Cr_2O_3$ and as low in FeO as possible. Results of tests in a small lab. indirect arc furnace are discussed. Low temperatures favor Cr reduction. The effi- 10 ciency of ferrosilicon in reducing $Cr_2O_3$ was 75-81%. Steel containing at least 12% Cr and not more than 0.75% Si should be possible. Costs of stainless steel manufacture by the ordinary indirect method are estimated as £15.11/ton; £12.34 by the direct method. AHE (2b)

# 3. MELTING, REFINING AND CASTING

**Porosity of Die Castings.** K. V. PEREDELSKI. *Liteinoe Delo,* Vol. 7, No. 7, pages 10-13. In Russian. General considerations indicate that porosity does not exist when the pressure applied to metal is higher than a certain value and that the pneumatic type of machines leads to largest amount of blow holes. (3)

**Porosity of Die Castings.** BRUNO SACHS. *Liteinoe Delo,* Vol. 7, No. 7, pages 5-10. In Russian. Theoretical considerations affecting formation of blow holes and shrinkage cavities are discussed and supported by mathematical treatment. (3)

**Classification of Foundry Sand Binders (Beitrag zur Bewertung des Bindemittels im Formsand)** EUGEN SCHNEIDER & M. PASCHKE. *Giesserei,* Vol. 23, Oct. 23, 1936, pages 572-579. The quality of the binding material is determined by its colloidal properties, which manifest themselves in swelling after the sand is moistened. The colloids in sand are mostly clay-like substances. A method is described by which the binder can be isolated and examined separately or after compounding with other synthetic sands. Water sensitivity and colloid value as binder classification indices are defined and their characteristic curves for natural and synthetic sands are given. 9 references. Ha (3)

**Shrinkage.** H. A. SCHWARTZ. *Foundry,* Vol. 63, Nov. 1935, pages 27-28, 65, 66; Dec. 1935, pages 46, 49-50, 52; Vol. 64, Jan. 1936, pages 50, 52, 55-56; Feb. 1936, pages 50-52, 55-56; Mar. 1936, pages 54, 57-58; Apr. 1936, pages 60, 62, 66; June 1936, pages 50, 53-54; July 1936, pages 46, 48, 50; Aug. 1936, pages 46, 48, 51. Series of articles dealing with the importance of temperature distribution in cooling castings in connection with shrinkage. Considers conditions influencing temperature distribution. Gives a number of highly mathematical problems and their solution in determining the temperature distribution in metals. VSP (3)

**Sand Testing and Its Application in the Foundry** H. W. DIETERT. *Iron Age,* Vol. 138, July 30, 1936, pages 24-27. Reviews the need of sand control, and points out the influence of each sand characteristic on the physical properties of a casting. See *Metals and Alloys,* Vol. 6, July 1936, page MA 340L/4. VSP (3)

**General Account of the International Foundry Congress of Brussels, 20-29 September 1935 (Rapport sur le Congrès international de Fonderie de Bruxelle, 20-29 Septembre 1935)** *La Fonderie Belge,* Vol. 4, Oct.-Nov.-Dec. 1935, pages 327-360; Vol. 4, Jan.-Feb. 1936, pages 364-373. Account of all meetings, lectures and discussions. FR (3)

**Sweeping of Loam Cores (Noyautage de Formes en Terre)** TECHNICAL COMMITTEE OF THE BELGIAN FOUNDRYMEN'S ASSOCIATION. *La Fonderie Belge,* Vol. 4, Jan.-Feb. 1935, pages 193-194. Practical example of sweeping a tronconical loam core. FR (3)

**Study of Hand Molding (Etude du Moulage à la Main)** TECHNICAL COMMITTEE OF THE BELGIAN FOUNDRYMEN'S ASSOCIATION. *La Fonderie Belge,* Vol. 4, May-June 1936, pages 426-430. Study made by using a small portable tool for measuring hardness in different parts of molds. FR (3)

**Blowholes at the Upper Part of a Casting Just Under the Riser (Soufflures à la partie supérieure d'une pièce immédiatement sous l'évent)** *La Fonderie Belge,* Vol. 4, May-June 1936, pages 431-432. Methods of preventing defects due to the wrong location of risers are indicated. FR (3)

**Dimensional Tolerances for Castings (with Particular Reference to Malleable Cast Iron).** *Foundry Trade Journal,* Vol. 55, Aug. 6, 1936, pages 99-101, 105; Aug. 13, 1936, pages 125-128. Typical contraction constants for a number of the common casting metals, data on contraction of blackheart malleable, data on blackheart castings from regular production, practical tolerances for malleable cast Fe, dimensional tolerances on steel castings, dimensional tolerances on cast Fe, working tolerances for cast Fe, examples of contraction of non-ferrous metals, etc. are discussed. AIK (3)

**Fiftieth Anniversary of the Cathcart Works of G. and J. Weir, Limited.** P. ROX-ALLIN. *Foundry Trade Journal,* Vol. 55, July 30, 1936, pages 81-86. Description. AIK (3)

2 **Utilization of Burnt Core and Molding Sands for Thin-Walled Castings.** V. I. VOLKOV. *Liteinoe Delo,* Vol. 7, No. 7, 1936, pages 27-31. In Russian. Core sand used in production of radiators does not deteriorate during casting and cooling and can be added to advantage to molding sand without any previous treatment. (3)

**Porosity of Bronze Castings and Its Elimination.** D. S. VORONIN. *Liteinoe Delo,* Vol. 7, No. 7, pages 14-15. In Russian. 3 Porosity of bronze castings as evidenced by sweating under hydraulic testing was eliminated in one plant by filling cavities with lead. Porous castings are immersed in lead at 420-450° C. under 6 to 6.5 atmospheres for 7-10 minutes. They are removed, cleaned of lead and are ready for hydraulic testing. The treatment permits 95% to pass the test. The method was used in the plant for more than one year. (3)

**Applying Technical Control to Foundry Sand.** FRED L. 4 WEAVER. *Iron Age,* Vol. 138, Oct. 1, 1936, pages 36-37. Deals with the importance of technical control of sand in the foundry. Cites the automobile industry as being the leader in adopting technical control. States that sand control is based on taking basic elements of known characteristics and constructing a molding material best suited for all the conditions which should be under control, such as type of casting, its size and weight with respect to the kind and temperature of the metal. VSP (3)

5

## 3a. Non-Ferrous

G. L. CRAIG, SECTION EDITOR

**Speed in Gold Melting—Electric Reverberatory Furnace at Bulolo Has Automatic Controls and Large Capacity.** M. W. 6 MACAFEE. *Engineering & Mining Journal,* Vol. 137, Dec. 1936, pages 625-626, 629. The electric reverberatory furnace shown may be used for melting Au and other metals. The lower half of the cylinder contains the hearth and the upper contains the firing chamber. The unit is fabricated by electric welding and is sectionalized. It consists essentially of a cylindrical shell supported horizontally and divided into two parts. Melting is effected by strictly reverberatory heating of the surface of the charge in the hearth, the heat being supplied by carborundum resistance bars. The range of application of this furnace is not limited to 7 Au, Ag or cyanide precipitate melting, but may include brass or Cu melting with no modification in the hearth refractories or electric equipment. WHB (3a)

**Permanent Mold Castings in Aluminum.** R. J. ROSHIRT. *Iron Age,* Vol. 138, Nov. 5, 1936, pages 50-52, 134. Al castings for a great variety of parts, weighing from an oz. to 25 lb., are made in permanent molds for washing machines, vacuum cleaners and 8 a host of other products. Metal is claimed to be 20% stronger than the corresponding die cast part. Permanent mold castings are poured by gravity except that mold is semi-steel or high-test cast Fe in 3 sections, each actuated by an air ram. Core is also semi-steel and is lowered in place vertically. Gating must be generous particularly when gate joins casting proper. Permanent mold castings having dense homogeneous metal throughout give much better polish, although initial surface is rougher. With many new alloys, permanent mold castings can be improved 9 physically by proper heat treatment. Castings can be made as thin as 7/64 in. Some of the alloys used are S.A.E. No. 33 and 38. VSP (3a)

**The Molecular Structure of Nickel Carbonyl.** L. O. BROCK-WAY & P. C. CROSS. *Journal of Chemical Physics,* Vol. 3, Dec. 1935, pages 828-833. Previous work on the molecular structure of Ni carbonyl is intensively reviewed. In the present investi- 10 gation a sample of Ni carbonyl is vacuum distilled and pumped off while frozen with liquid air in order to remove CO, and the sample photographed at room temperature. Pauling's conclusion that Ni carbonyl is a tetrahedral molecule, with the dimensions Ni-C = 1.82 ± .03A.U. and C-O = 1.15 ± .02A.U., is verified. FPP (3a)

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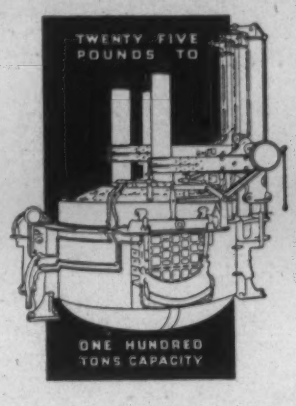


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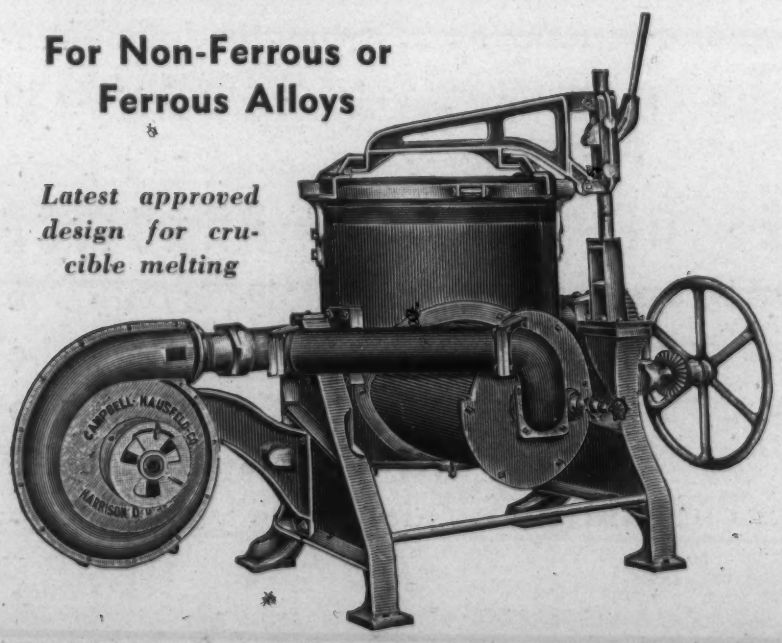


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1 **Defects Caused by Improper Gates.** N. K. B. PATCH. *Foundry,* Vol. 64, Aug. 1936, pages 26, 64. One of the greatest mistakes commonly found in gating of castings is the use of a gate which causes a squirting or nozzle effect. Ideal gating is that which allows metal to enter mold as quietly as possible and yet fills it with sufficient speed to avoid cold shots. Choke gates have in some instances been successful. In proper pouring the sprue should be kept full and therefore uniform pressure is maintained. Agitation by constricted nozzle is a most serious trouble in casting yellow brass, Al and Mn bronze, but not in casting red brass or some of the leaded bronzes. Other defects are dirt inclusions and slag spots also caused by the spray effect. VSP (3a)

2 **Development of the Rarer Metals—Increasing Production and Uses.** P. M. TYLER. *Metal Industry,* London, Vol. 48, Feb. 7, 1936, pages 184-186. This survey was taken from a review prepared by Dr. Tyler of the U. S. Bureau of Mines and published by the A.I.M.M.E. The metals briefly discussed are Sb, Be, Cd, Cr, Co, Mo, Re, Se, Ta, Te, Ti, W and V. HBG (3a)

3 **The Influence of Colloids, Current Density and Temperature on the Physical Nature of Cathode Deposits and the Current Efficiency of Bismuth Electrolysis (Einfluss von Kolloid, Stromdichte und Temperatur auf die physikalische Beschaffenheit der Kathodenniederschläge und die Stromausbeute der Wismutelektrolyse)** H. BORCHERS & G. STALMAN. *Metall und Erz,* Vol. 33, Feb. 2, 1936, pages 94-99. A detailed study is made of the electrolysis of Bi solutions, for the purpose of establishing ideal conditions for the electrolytic refining of Bi ore. The electrolyte was an HCl solution containing Bi and the colloid was gelatine. 4 Temperature was varied between 20° and 75° C., current density between 100 and 800 amps./m.$^2$ and gelatine content between 0 and 1 g./l. of electrolyte. In the absence of colloid it was found that adherent, but rough deposits were obtained as the current density was raised above 200 amps./m.$^2$; some values below this were satisfactory. Deposit quality and current efficiency were improved by increasing the temperature. The optimum gelatine content was found to be .01 g./l. The character of each deposit is illustrated by a photograph. FPP (3a)

5 **Two Cases of Use of External Chill (Coolers) in Bronze Foundry (Deux cas d'utilisation de Refroidisseurs Externes en Fonderie de Bronze)** J. GOUDMAN. *La Fonderie Belge,* Vol. 4, Jan.-Feb. 1935, pages 181-182. The use of external chills has reduced defects previously encountered and increased hardness and soundness of castings in the case of a slide and of a worm wheel. FR (3a)

6 **Zinc Bronze Composition "G," Treating It for Pressure Tightness.** FRANCIS C. JENKINS. *Metals & Alloys,* Vol. 7, Nov. 1936, pages 279-286. Compilation of practices for the production of pressure tight castings of "G" metal, 88% Cu, 8-10% Sn and 2-4% Zn. 34 references. WLC (3a)

## 3b. Ferrous

C. H. HERTY, SECTION EDITOR

7 **Some Metallurgical Applications of the C-SiC Thermocouple.** G. R. FITTERER. *Metals Technology,* June 1936, *American Institute Mining & Metallurgical Engineers Technical Publication* No. 717, 14 pages; *Transactions American Institute Mining & Metallurgical Engineers,* Vol. 120, *Iron & Steel Division,* 1936, pages 8 189-216. Describes investigations made with C-SiC thermocouple of temperature changes in the mixer, variation in blast-furnace tapping temperatures, variations of temperature in the car-type ladle, effect of casting temperatures on life of ingot molds, temperature measurements of liquid steel in basic open-hearth furnace, and of ladle pouring temperatures of acid open-hearth Fe and steels. Discusses development of solidification diagram for pig Fe containing 1.5% Si and 0.50% Mn from data secured from tonnage lots of Fe with the thermocouple. An explanation of 9 the effect of casting temperature on mold life is given. Temperature readings obtained with the thermocouple are contrasted with those obtained optically and it is shown that in some instances thermocouple temperatures were apparently correct while others were not. JLG (3b)

10 **The Influence of Blast Volume on Converter Steel.** A. NETESIN & M. VENGRENOVICH. *Stal,* Vol. 6, Feb. 1936, pages 7-25. In Russian. Increasing the blast volume decreases the slag inclusions and increases the N and O content in the steel. HWR (3b)

**Pours Six 130-Ton Steel Castings for Mill Housings.** W. G. GUDE. *Steel,* Vol. 98, June 1, 1936, page 56. See *Metals and Alloys,* Vol. 7, Oct. 1936, page MA 492L/10. MS (3b)

Ohio Ferro-Alloys Corporation
Canton, Ohio

**Influence of Time and Intensity of Boiling on Quality of Steel.** K. I. FEDOROV. *Metallurg,* Vol. 11, Aug. 1936, pages 27-39. In Russian. A series of experiments was conducted in two 30 ton open hearth furnaces in which time and intensity of boiling were varied artificially. The least amount of non-metallic inclusions was obtained after boiling for 2.5-3 hours. With a longer or shorter boiling their number increases, particularly in regard to FeO and $Fe_2O_3$ inclusions. Longer boiling decreases amount of sulphide inclusions. Keeping heats in the furnace after addition of deoxidizers cleans the steel, but keeping in the ladle does not. The least amount of inclusions corresponds to the best physical properties. (3b)

**Open-Hearth Temperature Control.** EARNSHAW COOK. *Transactions American Society for Metals,* Vol. 24, Sept. 1936, pages 649-678. Paper presented and discussed at the Chicago Convention of the Society, 1935. Discusses calibration methods and the use of optical pyrometers for steel making temperature control. Frequent standardization upon known constant temperature points are satisfactory for the use of optical pyrometers in such control even though actual temperatures obtained are not true temperatures. Operating data covering relations of tapping and teeming temperatures to time of holding in the ladle for various C content steels and the relation of such temperatures to skull formation are given. WLC (3b)

**Influence of the Basic Metal on the Equilibrium of Metallurgical Reactions (Der Einfluss des Grundmetalls auf die Gleichgewichte Metallurgischer Reaktionen)** W. OELSEN. *Zeitschrift für Elektrochemie,* Vol. 42, July 1936, pages 557-561. The equi librium between molten metal and slag may be expressed by the ideal law of mass action even though the metal and slag usually exist as 2 layers. For the reaction:

$$Si + 2MnO \rightleftarrows SiO_2 + 2Mn$$

Mn is dissolved in the metal layer in the case of Fe, Co, Ni and Cu and the slag consists of a large amount of silicic acid practically saturated with Mn silicate. For the molten metal layer there exists the following relation between Si and Mn at 1600° C.:

In Fe melts, (Si) equals 0.56 $(Mn)^2$
In Cu melts, (Si) equals 0.25 $(Mn)^2$
In Ni melts, (Si) equals 0.068 $(Mn)^2$
In Cu melts, (Si) equals 0.009 $(Mn)^2$

The constants give some idea of the reciprocal influence of the dissolved Mn and Si in the various melts. HAS (3b)

**Green Sand Core for Making Iron Pipe.** *Foundry,* Vol. 64, Sept. 1936, pages 31, 76. If made properly, green sand core presents many advantages over any other type for making cast Fe pipe. Binder and fuel are eliminated and material may be used over again. Core is true to shape and size and fits closely to prints. Strong arbor prevents core from springing, insuring uniform casting without use of chaplets. In jobbing foundry core barrel is mounted in cast Fe ends of empty drag and sand is packed on by hand to desired thickness. Size, shape and number of vent holes in barrel depend on permeability of sand and thickness of casting. Gas formed in barrel must be ignited before pouring metal. VSP (3b)

**The Alkali Oxide Systems—$CaO$-$Al_2O_3$-$SiO_2$-$CO_2$. Part VI. Equations in the System $CaO$-$SiO_2$-$CO_2$ (Ueber die Systeme Alkalioxyd—$CaO$-$Al_2O_3$-$SiO_2$-$CO_2$. VI Die Gleichgewichte im System $CaO$-$SiO_2$-$CO_2$)** C. KRÖGER & K. W. ILLNER. *Zeitschrift für anorganische und allgemeine Chemie,* Vol. 229, Oct. 27, 1936, pages 197-224. Discussion and numerous data for the reactions. WB (3b)

**Charging of Open-hearth Furnaces (Die Technik des Beschickens von Siemens-Martin-Oefen)** G. STRIEGAN. *Stahl und Eisen,* Vol. 56, June 25, 1936, pages 728-731. A direct relation is shown between charging time and melting time and the importance of reducing charging time is emphasized. SE (3b)

**Construction and Operating Figures on Open Hearth Furnaces Using Mixed Gases (Bau und Betriebszahlen von Siemens-Martin-Oefen mit Mischgasbeheizung)** F. WESEMANN. *Stahl und Eisen,* Vol. 56, June 11, 1936, pages 677-684. In evaluating open-hearth furnaces the fuel consumption per ton comes foremost. The construction of the burners, the section of the ports and downtakes, and the size of the stock affect this. The size of the gas chambers is also important since this affects the breakdown of methane and hence the luminosity of the flame. SE (3b)

**Experiences in the Making of Basic and of Acid Open-Hearth Bottoms (Erfahrungen über die Zustellung von basischen und sauren Siemens-Martin-Herden)** H. J. MEYER & H. ABKER. *Stahl und Eisen,* Vol. 56, July 16, 1936, pages 815-818. Details for making magnesite and dolomite bottoms for basic furnaces and of sand bottoms for acid furnaces are given. SE (3b)

**A New Development in Steel Making Control.** METALLURGICAL STAFF OF REPUBLIC STEEL CORP., CLEVELAND. *Iron Age,* Vol. 138, Oct. 1, 1936, pages 42-44. One of the fundamentals in steel making is the determination of gases and oxides as well as other impurities that are the primary cause of failure in steel. Considers the shortcomings of the Ledebur and Allen methods. Discusses the modified vacuum fusion method developed by the Republic Steel Corp. By this method it is possible to differentiate between the oxides and to determine quantitatively gases present. It consists of partial extraction at different elevated temps. at which Fe, Mn, Si, Al and other oxides are individually reduced. Gives procedure. (Method resembles that previously described by A. O. Smith Corp. research staff.) VSP (3b)

**Alloy Additions Used in Making Alloy Steels (Legierungen in der Edelstahlerzeugung)** B. MATUSCHKA & F. CLESS. *Stahl und Eisen,* Vol. 56, July 2, 1936, pages 757-766. Supplementary to a previous article on Cr and W ferro-alloys, the following alloying elements or ferro-alloys are discussed:—Ni, Co, Mo, Mn, Si, Al, Cu, V; in particular their composition, structure, and ease of melting. SE (3b)

**Non-metallic Inclusions in Cast Iron. A Review of the Literature.** E. MORGAN. *Bulletin of the British Cast Iron Research Association, No. 4,* No. 9, Report No. 152, July 1936, pages 355-361. Inclusions of sub-microscopic size, colloidal dimensions, are suggested as most potent in affecting properties of Fe. Accidental origin of inclusions considered as due to contamination of metal with refractory of furnace, ladle, mold but of such size as to affect the macrostructure but not the properties of the metal. Colloidal, harmful inclusions originate in slag of blast furnace and are carried along in the processing, and others may have their inception in the release of oxidizing gases during cooling of molten Fe. The trapped gases themselves are regarded as harmful inclusions. Review of literature on effect of dissolved $O_2$ indicates it gives cast Fe a different structure (finely divided graphite) when absent than when free access to $O_2$ is the case (coarse graphite flakes) and whether or not the effect is beneficial is inconclusive. Graphite is removed from category of inclusion since literature shows it is completely dissolved (subeutectics at least) in molten Fe. Theory is advanced that silicate inclusions are most important, being most persistent and capable of sub-microscopic subdivision, thus able to affect the crystallization of the metal, forming coarse graphite, but partial liquefaction of the inclusion can prevent its action as nucleus and thus remove it from sphere of influence with respect to properties of the metal. Bibliography appended. WB (3b)

**Mold Coating Prevents Chill.** *Foundry,* Vol. 64, Sept. 1936, pages 58-61. Interesting description of method used in the casting of corrosion resistant alloy Fe pipes published in *U. S. Piper,* a publication of the United States Pipe & Foundry Co., Burlington, N. J. Pipes are made of Ni-resist by the super deLavaud process. Pipe cast by this method ordinarily has the typical structure of cast Fe when cast against a chill, a well defined chill area, where molten Fe comes in contact with $H_2O$ cooled mold. This area subsequently is eliminated by annealing. Recently a chill-free pipe was cast by depositing a film of pulverulent material, which does not react chemically with the Fe, on the mold prior to contact of the molten Fe. The coating is deposited by a stream of carrier gas through a nozzle located on pouring trough a few in. back of pouring spout. Unalloyed pipe made according to this method is said to be 100% more resistant to impact shock than chilled pipe. Ni-resist pipe cast by this process is free from chill and shows a homogeneous structure throughout. VSP (3b)

**Cupola Produces Huge Tonnage.** *Foundry,* Vol. 64, Aug. 1936, page 27. Claimed to be a record day's run when a large cupola of the American Cast Iron Pipe Co. melted 354 tons of Fe. Elapsed time between putting on and shutting off the blast was 10 hrs. and 20 min. Cupola measures 72″ on short diam. and 102″ on long diam. inside the lining at tuyeres. Includes a table giving details of cupola operations for 3 heats. VSP (3b)

**Cement-Bonded Sand Used by Mold Maker.** *Iron Age,* Vol. 138, Nov. 19, 1936, pages 51, 89. Describes the Randupson process of cement-bonded sand molding by the Vulcan Mold & Iron Co., Latrobe, Pa. Consists of a molding sand mixture composed of silica sand (98% pure), "high early strength" Portland cement, and water. Ramming of mold may be done in any one of usual ways. After ramming mold is air dried naturally for 24-72 hrs. previous to casting. After drying, a coating is applied. Patterns of usual type are used for solid molds. For split molds and other similar castings, molding is done in cores with frame to form outside mold. Gives an illustration of the manufacture of an ingot mold to show differences between Randupson and old method. VSP (3b)

**Experiences with the New Reversing Mechanisms on Open-hearth Furnaces (Erfahrungen mit neueren Umsteuervorrichtungen von Siemens-Martin-Oefen)** *Stahl und Eisen,* Vol. 56, Aug. 27, 1936, pages 965-970. The efficiencies of the various new types of reversing mechanisms for the air and gas in open-hearth furnaces are discussed. SE (3b) 1

**Blow-holes (Soufflures)** TECHNICAL COMMITTEE OF THE BELGIAN FOUNDRYMEN'S ASSOCIATION. *La Fonderie Belge,* Vol. 3, Nov.-Dec. 1934, pages 162-166. Elementary. FR (3b) —

**Chaplets (Supports à Noyaux)** TECHNICAL COMMITTEE OF THE BELGIAN FOUNDRYMEN'S ASSOCIATION. *La Fonderie Belge,* Vol. 3, July-Aug. 1934, pages 100-102. Various types of chaplets are described and conditions of use are discussed for each type of chaplet. FR (3b) 2

**Influence of Linseed Oil added to Molding or Core Sands on the Structure of Cast Iron (De l'Influence de l'Huile de Lin Incorporée dans les Sables de Moules ou de Noyaux sur la Texture de la Fonte)** TECHNICAL COMMITTEE OF THE BELGIAN FOUNDRYMEN'S ASSOCIATION. *La Fonderie Belge,* Vol. 3, Jul.-Aug. 1934, pages 94-99. Bottoms of molds when impregnated with linseed oil and then dried are hard, do not produce much gas and are more resistant to impact and high temperatures. When too much linseed oil is put on flat surfaces of molds a spongy part is noted under a hard layer of metal. Best results are obtained with raw linseed oil. The higher the chill-ability of cast Fe the higher the hardening effect of linseed oil put on mold surface. Linseed oil when added to silica sand gives a higher hardness to the metal than when added to molding sand. Tests have been made in practical conditions. FR (3b) — 3 — — 4

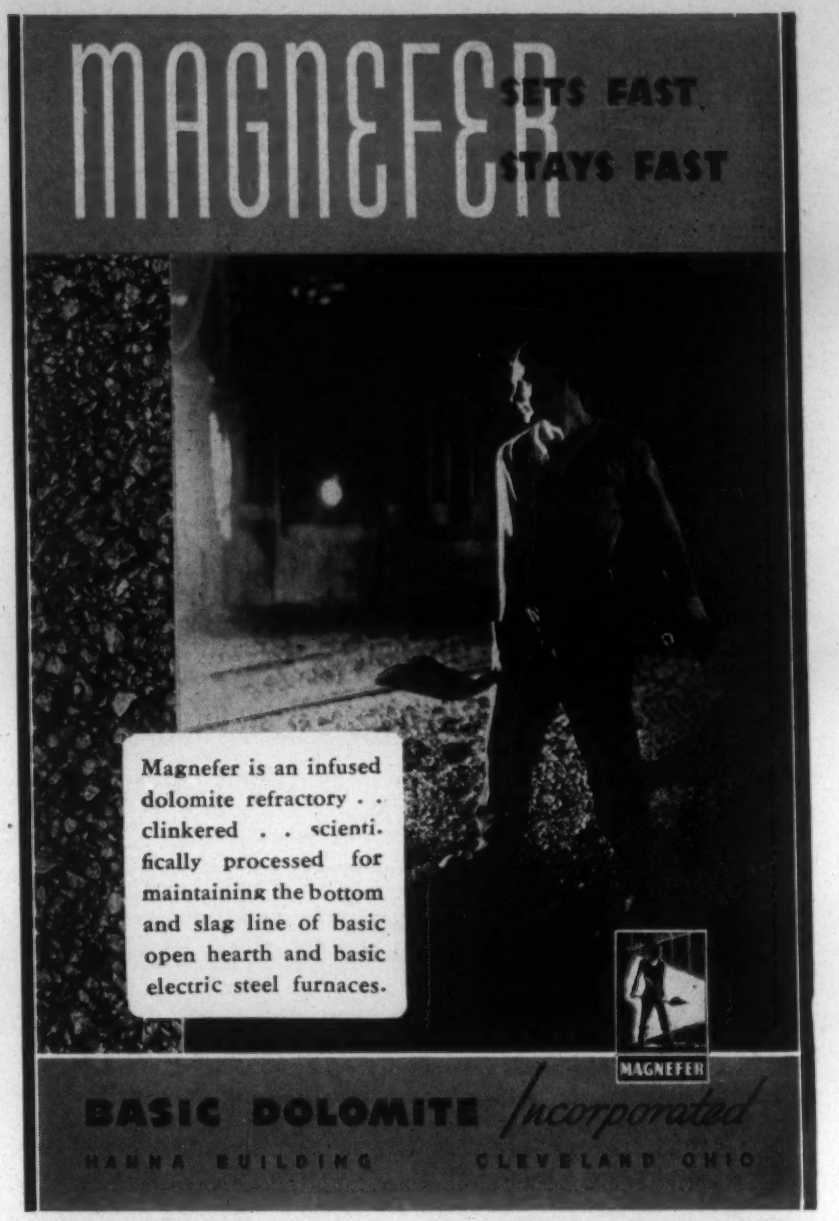
**Theoretical and Practical Study of Melting in Cupolas (Etude théorique et pratique de la Fusion aux Cubilots)** A. POUMAY, JR. *La Fonderie Belge,* Vol. 3, May-June, 1934, pages 80-88. Gives the mathematical fundamentals of melting in cupolas of any type. Determination of efficiency limitations and of factors which are involved in the actual results are indicated. The usefulness of "Poumay process," in which additional air is introduced above usual rows of tuyeres, is shown. See *Metals and Alloys,* Vol. 5, Aug. 1934, page MA386. FR (3b) — 5

**Moulding a Cast-Iron Stool for a Pump Motor.** H. GREENHOUSE. *Foundry Trade Journal,* Vol. 55, Aug. 13, 1936, pages 121-122. Entry in a short paper competition held by the Birmingham branch of the Institute of British Foundrymen. The casting formed the baseplate for a 1,500-hp. vertical pump motor, and was part of the equipment required for the large graving-dock at Southampton. Its diameter on the outside flange is 10 ft. 6 in. and the over-all depth is 2 ft. 4½ in. Paper is illustrated with photographs showing mold and core in different positions. AIK (3b) — 6

**Deoxidation of Electric Steel.** ALBERT E. GREENE. *Iron Age,* Vol. 136, Apr. 23, 1936, pages 37-39. The particular phase of steel treatment discussed is the process by which more thorough deoxidation is accomplished, and particularly when it is done prior to alloy or Al additions to steel in the furnace. This method is a modification of the Greene slag process. Deoxidation is done during slow melting rather than by fast melting. Slag control should begin early in heat so that work will be done by the time first sample is taken. Scrap suitably free from P and S should be used to avoid oxidation or boiling. Method may be used in either acid hearth or basic hearth furnaces. Iron oxide reduction is accomplished by fine C or coke. Ferrosilicon may be used as reducing agent, usually only in basic hearth furnaces. Once deoxidized to desired extent steel can be further treated as desired, alloyed or super-heated. Another characteristic of this more thoroughly deoxidized steel is its apparent increased resistance to rusting. VSP (3b) — 7 — — 8

**Recovery, Preparation and Handling of Molding Sand (Récupération, Préparation et Manutention des Sables de Moulage)** LESTER B. KNIGHT, JR. *Bulletin de l'Association Technique de Fonderie,* Vol. 10, May 1936, pages 183-191. American exchange paper presented at the Foundry Congress, Lille, 1936. Detailed description of American practice in sand handling. WHS (3b) — 9

**Cast Iron and Reactive Slag (La Fonte et les Laitiers Réactifs, Brassage Ordonné et Brassage Émulsif, Applications en Première et en Seconde Fusion)** L. F. C. GIRARDET. *Bulletin de l'Association Technique de Fonderie,* Vol. 10, June 1936, pages 203-207. Paper presented at the 15th Annual Congress of the A. T. F. Agitation of the metal aids in hastening equilibrium and segregation of particles. This agitation of the molten metal is secured by direction of flow from furnace into a specially shaped ladle. Purification of the metal is aided by the presence of a soda slag in the ladle. 13 references. WHS (3b) — 10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UNITED STATES STEEL

**Symposium on Cast Iron.** *Foundry Trade Journal,* Vol. 55, Aug. 6, 1936, pages 95-97. Discussion on papers presented at the annual conference in Scotland of the Institute of British Foundrymen and dealing with various aspects of cast Fe. The two-cupola method, section sensitivity, Brinell test and tensile ratios, fracture of pig-Fe, Ti, refining process, etc. were discussed. With regard to the mechanism of the Ti effect on graphitization, A. L. Norbury stated that the Ti slag inclusions could be seen in the microstructure of the metal. He thought that these inclusions were still liquid when the graphite solidified, and consequently did not have an inoculating action, and the fine graphite structure resulted. AIK (3b)

**Solidification Time of Ingot Shapes (Die Erstarrungsdauer beim Guss von Blockformen)** K. KUEHANS & N. BERNDT. *Stahl und Eisen,* Vol. 56, Aug. 27, 1936, pages 970-972. The minimum time at which solidification occurs in various type ingots was determined by means of time-temperature measurements. SE (3b)

**Manufacture of Ingot Molds for Steel Plants (Fabrication des Lingotières d'Aciérie)** J. LÉONARD. *La Fonderie Belge, Vol.* 3, Jul.-Aug. 1934, pages 117-124. Lecture before the Siderurgical Technical Association of Charleroi. Conditions met with in service by ingot molds discussed. A producer of ingot molds obtains good results by shaking out the castings when they are still red hot and placing them in pits. The author summarizes the work of Le Thomas on inside-face corrosion, which showed that rapidly cooled cementite is less stable than slowly cooled. Some authors advocate large grain structure whereas others prefer a fine one. According to Leonard it would be interesting to try a cast Fe containing 0.4-0.5% Mn, about 1.2% Si, 3.6-3.7% T.C. The ferritic structure being desired, cooling of the casting should be very slow. If cast Fe melts are thoroughly deoxidized with 15% V-Ti cast Fe pig in the charge, an increase of life of 75% may be obtained. FR (3b)

**Improvement of Mechanical Properties of High-grade Gray Iron by Quenching and Drawing (Verbesserung der mechanischen Eigenschaften von hochwertigem Grauguss durch Abschrecken und Anlassen)** A. LE THOMAS. *Giesserei,* Vol. 23, July 3, 1936, pages 339-341. The heat treatment of cast Fe reduces the stresses due to temperature and structural differences. The higher the quality of the gray Fe, the more quenching and drawing will improve the mechanical properties. If it is not possible to cast directly from the electric furnace, a second melt must be made in which C should not exceed 2.9-3% and oxidation and sulphurization are avoided. This second melt should preferably be made in an electric furnace or rotating oil furnace. Quenching is possible only with pieces of simple shape to avoid interior stresses and cracking. By addition of alloying elements (Ni, Cr, Mo and Mg) the improvement by heat treatment can be enhanced. Ha (3b)

**Abnormalities in Depth of Chill of Cast Iron and their Relation to Manufacture Uniformity (Les Anomalies de Trempe des Fontes et leur Rapport avec la Régularité des Fabrications)** AUGUSTE LE THOMAS. *La Fonderie Belge,* Vol. 3, May-June, 1934, pages 58-73. Lecture before the Belgian Foundrymen's Association. A first kind of depth of chill abnormality is that due to a high S content. On this case an external layer of gray cast Fe is noted on the fracture of the castings whereas a white heart structure is seen in the internal part of the casting thickness. This phenomenon is called internal or reversed chill. This defect appears very suddenly in course of manufacture. To avoid this defect 2 means are available (a) to modify the manufacture condition in order to decrease the S content of the metal. (b) To increase by suitable pig Fe additions the Mn content of the cast Fe. The author points out that very often another defect is observed in the case of high S content cast Fe, that called "white spots" which is met on surfaces of large castings in the vicinity of reentrant angles of the castings. This defect can similarly be avoided by an increase of Mn content. A second kind of depth of chill abnormality is that due to oxidation of the molten bath. In this case the depth of chill is considerably higher than that which should be obtained according to the composition of the cast Fe. If a treatment is applied or an addition is made just before pouring in order to deoxidize the metal, the depth of chill abnormality is suppressed despite the fact that composition as normally expressed in technical literature has not been apparently affected. The second abnormality is an hereditary property of the metal i.e., it is kept after remelting if no deoxidation is resorted to. Last section of the article points out that the modifications due to melting conditions in experimental works on cast Fe have not been sufficiently taken in account. In order to prevent depth of chill abnormalities it is of good practice to avoid the use of unknown cast Fe scraps and to control melting conditions to avoid oxidation. FR (3b)

# 4. WORKING

**The Plastic Deformation of Metals and the True Ultimate Tensile Strength.** YASUMASA TUANI. *Bulletin of the Institute of Physical & Chemical Research, Tokyo,* Vol. 15, Aug. 1936, pages 730-753, Sept. 1936, pages 937-950. In Japanese. *Scientific Papers and Abstracts of the Institute of Physical & Chemical Research, Tokyo,* Vol. 30, Sept. 1936, pages 50-51. In English. The hardening effect by plastic deformation of pure metals is assumed to be due to atoms changing their relative positions by slipping, thus minimizing the probability of further slipping. This new configuration will be maintained as a quasi-stationary state ("internal stress") even after the external load is removed. The Bauschinger effect is interpreted on this basis. A quantitative relation between recrystallization temperature and degree of strain hardening is derived. The following approximate relation between plastic elongation and tensile stress is deduced and claimed to be in agreement with short-time tensile testing results:

$$\log (l/l_o) = p^2/p'^2$$

wherein $l_o$ = initial length, $l$ = length after elongation corresponding to the stress p; p', a constant which depends on the kind of metal and testing temperature, is proportional to the true ultimate tensile strength of the metal. It is theoretically shown that this true ultimate tensile stress can be expressed as a function of the melting point, lattice constant, and testing temperature of the metal. A relation between stress and amount of plastic deformation by compression or torsion is also set forth. This formula is of the same type as that given above. WH (4)

## 4a. Rolling

S. EPSTEIN, SECTION EDITOR

**The Roll Problem in Backed-up Mills for Cold Reduction.** GEO. A. V. RUSSELL & S. S. SMITH. *Iron & Steel Institute,* Advance Copy No. 14, Sept. 1936, 26 pages. The paper is a record of experience with both the working and backing rolls in a large installation for rolling Cu. The various types of rolls used or now available are considered from the standpoints of use and manufacture. Characteristic modes of failure are illustrated and examined. Stress relationships are contrasted with those obtaining in rolls in ordinary 2-high type mills. It is suggested that working rolls of greater strength, such as those made from steel containing 2% C and 12% Cr, be tried. The use of alloy cast Fe rolls is also suggested. Backing rolls shoud be supplied with a steel shell. Both working and backing rolls should have relatively large diameters. JLG (4a)

**Flow-Hardening in Cold Rolling.** W. TRINKS. *Blast Furnace & Steel Plant,* Vol. 24, July 1936, pages 600-602. Presents a purely mechanical explanation of flow hardening. Amount of hardening depends upon shearing deformation which material undergoes from annealed, soft state. Cold rolled metal is much harder than same material elongated same amount by tension, due to additional shearing deformation produced in rolling. Study of forces acting in cold rolling indicates that there is severe sliding through some angle $\alpha$ right at the skin near the entrance, and a sliding back through a similar angle $\beta$ near the exit, resulting in flow hardening near the surface. In tests with very large rolls on wax strips ¼" thick, surface layers were, under certain conditions, sheared off main body of strip. Amount of flow hardening varies with angles $\alpha$ and $\beta$. Angle $\alpha$ increases with friction force which pulls bar in and with horizontal forces caused by vertical pressure which pushes it back. Many passes with small reduction (everything else being equal) harden strip much more than 1 pass with 1 heavy reduction equal to sum of the many small reductions. Small roll diam., lubrication between rolls and bar, and forward and backward pull on bar reduce amount of flow hardening. In a skin pass, where flow hardening is desired, large diam. rolls and no lubrication should be used. MS (4a)

**New Derivation of Hertz' Hardness Formulae with Respect to Rolling (Neue Ableitung der Hertzschen Härteformeln für die Walze)** LUDWIG TÖPPEL. *Zeitschrift für angewandte Mathematik & Mechanik,* Vol. 16, June 1936, pages 165-170. The mathematical theory of elasticity (hardness) is still in its infancy. A few attempts have been made to enlarge the classical derivations of Hertz to an analysis of 2 contacting balls or a ball in contact with a plane. Töppel studies the technologically important case (rolling) of 2 cylinders pressed together or a cylindrical body in contact with a sheet. WH (4a)

## 4b. Forging & Extruding

A. W. DEMMLER, SECTION EDITOR

**Forging of Brass.** CHARLES M. ROSE. *Heat Treating & Forging,* Vol. 22, Aug. 1936, pages 381-382. Brass is forged by both hammer and press forging, latter being used for greater part of tonnage produced. Press forging produces a minimum of flash, and reduces fabrication problems to a minimum also. Normal forging temperature is 1350°-1400° F. For hammer forgings, die construction and hardening are similar to those used for steel. For press forgings, the die-block is kept as small as possible and complete die-block is hardened. Steels for press dies generally contain W, resembling high-speed type. All brass forgings are cleaned and pickled after trimming. MS (4b)

## 4c. Cold Working — Shearing, Punching, Drawing & Stamping

**Spun Metal Parts Reflect Ingenuity of Skilled Artisans.** *Steel,* Vol. 99, Aug. 31, 1936, pages 44-45. Describes and illustrates some of the operations performed at the Artistic Metal Spinning & Lamp Mfg. Co., Cleveland. MS (4c)

**Enameled Steel Sinks Produced Economically.** F. L. PRENTISS. *Iron Age,* Vol. 138, July 23, 1936, pages 22-24. Describes the production of pressed steel enameled sinks by the Youngstown Pressed Steel Co., Warren, Ohio. See *Metals and Alloys,* Vol. 6, Sept. 1935, page MA 378L/7. VSP (4c)

## 4d. Machining

H. W. GRAHAM, SECTION EDITOR

**"Crobalt" Enters National Cutting Field.** *Iron Age,* Vol. 138, Sept. 10, 1936, pages 56-57. Crobalt was developed by the Michigan Tool Co. about 1924. It is a non-ferrous high speed cutting alloy whose main ingredients, W, Co and Cr are combined with other constituents that are said to be responsible for its high cutting efficiency and long life. VSP (4d)

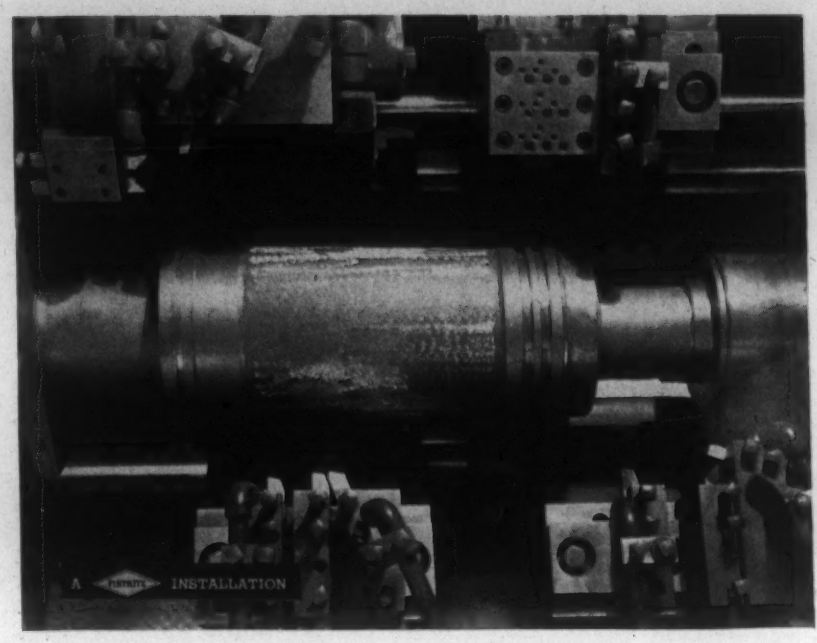
**With-the-Feed (Climb) Milling.** E. RÖMER. *Engineering Progress,* Vol. 12, Aug. 1936, pages 185-186. The advantages of milling with the feed of the piece are mainly that the surface of the work is considerably cleaner and more uniform and the life of the cutter between grinds is from 3 to 5 times as long due to the smallness of the radial force and the absence of chattering. Ha (4d)

**The Science and Practice of Machining Brass.** M. KRONENBERG. *Metal Industry,* London, Vol. 48, Feb. 7, 1936, pages 179-183. The author points out that machinability of brass, in marked contrast to the rapid progress in the science of metal cutting in the ferrous field, has not been systematically studied. Little information is available and none regarding relations between chip area, cutting pressure and cutting capacity. Some results conducted at Berlin Technical University on cutting pressure investigations on brass are discussed. It is shown that specific cutting pressure decreases for increasing areas of chip. It is indicated that cutting speed is not a constant for the same material and tool. The fallacy of a distinction of "roughing cut" and "finishing cut" and the designation of a cutting speed for each is deplored. The dependence of cutting speed on chip areas varies for different alloys. Examples given include Elektron, wrought brass, cast brass, S.M. steel, and medium hard cast Fe. Cutting capacity is briefly discussed. Due to the large number of factors that influence metal cutting, the author suggests that instruction sheets should be prepared which practical men can understand. By using these sheets they would be able to interpret and use results obtained in scientific investigations. A "capacity diagram" for brass has been prepared showing areas of chips ranging from 0.0001 to 0.007 in.$^2$ on the X-axis and cutting speeds ranging from 100 to 7000 ft./min. on the Y-axis. HBG (4d)

**The Maintenance of Industrial Chemical Plant.** W. G. TYDEMAN. *The Industrial Chemist,* Vol. 12, June, 1936, pages 294-298. A description of machine tools of late design. RAW (4d)

**A Method of Producing Spherical Surfaces With the Milling Machines.** S. HARIHARAN. *Journal of Scientific Instruments,* Vol. 8, Aug. 1936, pages 267-268. RAW (4d)


# 16 CUTS AT ONE TIME

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# 5. HEAT TREATMENT

O. E. HARDER, SECTION EDITOR

**Up-to-Date Heat Treating Equipment at the Chevrolet Plant.** J. B. NEALEY. *Machinery,* N. Y., Vol. 43, Oct. 1936, pages 118-120. Gas-fired heat treating furnaces, nitriding furnaces and their auxiliary equipment are described. Ha (5)

**Saving of Material with Electric Heat (Werkstoffersparnis durch Elektrowärme)** MICHAELIS. *Elektrowärme,* Vol. 6, Nov. 1936, pages 309-310. An installation of electric furnaces for heat treating valve seats and stems is described. Ha (5)

**Transformation-, Hardening- and Tempering-Phenomena in Steels with up to 1% C and up to 12% Cr (Umwandlungs-Härtungs- und Anlassvorgänge in Stählen mit Gehalten bis 1% C und bis 12% Cr)** W. TOFAUTE, A. SPONHEUER & H. BENNEK. *Technische Mitteilungen Krupp,* Vol. 4, Nov. 1936, pages 172-180. Literature on the system Fe-Cr-C is reviewed and new experiments to enlarge the knowledge of this constitutional diagram are described. Five sections parallel to the Fe-Cr and Fe-C side were made and investigated. Increasing Cr content shifts the transformations to higher and lower temperatures in such manner that the γ-range is closed off and the solubility of γ-Fe for C reduced. The cooling velocity required for hardening is reduced considerably by Cr addition. Due to the occurrence of special carbide $(Cr, Fe)_7C_3$, the hyper-eutectoid steels must be hardened just below the solubility area for the special carbide in order to attain highest hardness. The penetration of hardening is improved with increasing Cr content. Steels containing this special carbide show a higher temper constancy due to carbide precipitation, which increases with increasing amount of the dissolved special carbide. With Cr contents of more than 5%, larger amounts of residual austenite remain after quenching from very high temperatures but disintegrate in tempering above 500° C., and increase the temper constancy. Steels free of special carbide show a slightly retarding effect of Cr on the martensite disintegration. 15 references. See *Metals and Alloys,* Vol. 7, Feb. 1936, page MA 74R/7. Ha (5)

**Quality Heat Treat Demands Precise Temperature Control.** C. E. PICKUP. *Industrial Gas,* Vol. 15, Oct. 1936, pages 20-22. Advantages of gas as fuel for close temperature control are discussed and control installations described. Ha (5)

## 5a. Annealing

**Coiled Silicon Strip.** BURTON LONGWELL. *Transit Journal,* Vol. 16, Dec. 1936, pages 18-19. The use of coiled Si-steel strip has increased tremendously in recent years. An electrically-fired atmospheric-controlled roller hearth furnace is employed through which the Si steel strip is pulled ribbon-like at a predetermined speed and temperature. The steel is then coiled at some distance from the exit tube of the furnace and at room temperature. Thus the stock lies flat when uncoiled at the users' punch press. Si-steel is generally employed in gages considerably lighter than can be produced directly off the hot strip mill. This necessitates cold working or rolling with subsequent anneal to restore the desired electrical properties. The continuous electrical annealing furnace is satisfactory for the proper heat treatment needed to restore the 2 electrical properties. The increased die life from Si strip use is due to: (1) absence of half-punches, nature of the mill scale on strip causing less wear and abrasion, closer gage tolerances, and greater hardness, so that a cleaner punch or shear is obtained. WHB (5a)

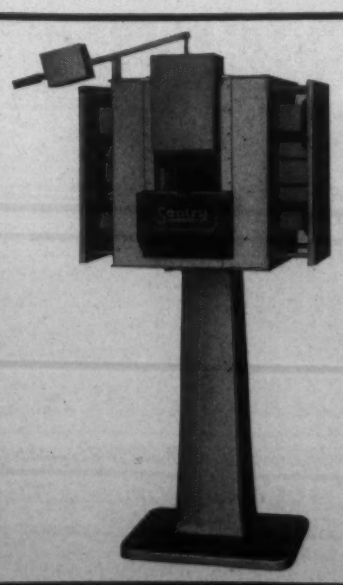
**The Recrystallization Temperature of Single Phase Metals.** A. A. BOTCHVAR & G. G. PUZIKIN. *Izvestia Sektora Fiziko-khimicheskogo Analiza,* Vol. 9, 1936, pages 153-158. In Russian. 3 The determination of recrystallization temperature of a sample must be based on measurements throughout the entire sample, as deformation is not uniform. NA (5a)

## 5b. Hardening, Quenching & Drawing

**The Case Hardening of Gray Iron by Beryllium.** JOSEPH LAISSUS. *Foundry Trade Journal,* Vol. 55, Sept. 17, 1936, page 4 222. Paper presented to the Seventh International Congress of Mining, Metallurgy and Applied Geology. The Fe used for the experiments (T.C 3.53%, Cr 3.08%, Si 2.47%, Mn 0.66%, S 0.033%, P 0.354%) was in the form of small cubes of 7 mm. each side and carefully polished. These were placed in the center of a cement made either of 98% pure Be or Fe-Be containing 80% Be. These were highly pulverized and mixed with 25% by volume glucine. Duration of cementation was 2½, 5 and 10 hrs.; 5 Temperature, 800, 900, 1000, 1100, and 1150° C. Diffusion of Be into gray Fe and properties of gray Fe cemented by Be are discussed. Cementation of gray Fe by Be is of the same order as that of Fe and ordinary C steels cemented by the same element; with this difference, however, that the layers obtained are of much greater magnitude in the case of Fe. Surface hardness of gray Fe cemented by Be is remarkable. The maximum figure obtained, 1,561 Vickers' hardness, exceeds those which had been considered the highest attainable with metals. For instance, nitrided steels 6 reached a figure of 1,100 to 1,200. The formation of rust by the action of either ordinary or salt water is retarded after having been cemented by Be, but this treatment is practically useless against the action of chemical reagents attacking non-cemented gray Fe. AIK (5b)

## 5e. Carburizing

7 **Rate of Decarburization and of Carburization of Iron, Nickel and Cobalt in Carbon Monoxide-Carbon Dioxide Mixtures (Entkohlungs- und Kohlungsgeschwindigkeiten von Eisen, Nickel und Kobalt in CO-$CO_2$-Gemischen).** E. DOEHLEMAUN. *Zeitschrift für Elektrochemie,* Vol. 42, July 1936, pages 561-569. The velocities of carburization and decarburization of Fe, Co and Ni foils in stagnant CO-$CO_2$ mixtures at 920°-970° C. were determined by following the change in electrical resistaance with a Kelvin bridge. Under the experimental conditions employed, the 8 reaction at the metallic surface is the rate-determining factor. Diffusion within the metal proceeds rapidly. Data from the experimental curves show that the decarburization velocity is (a) inde-

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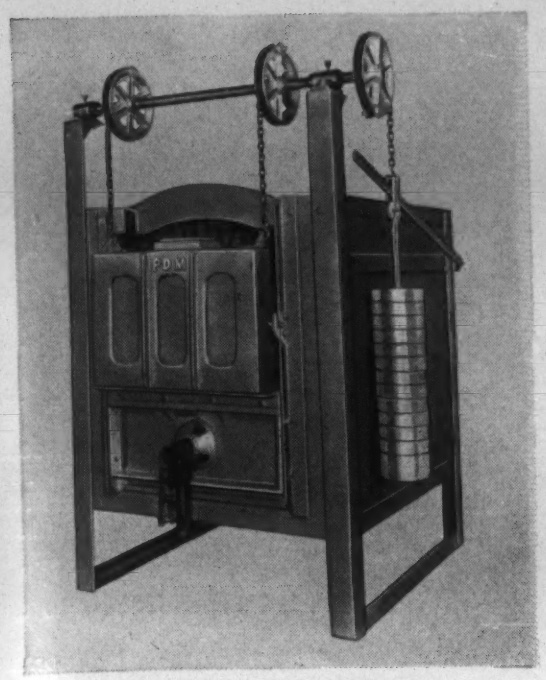

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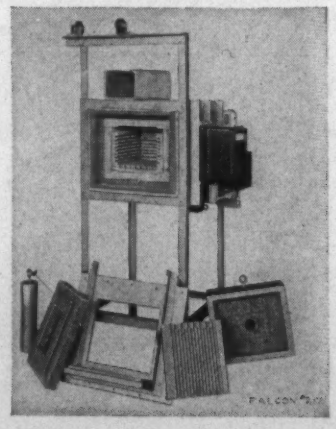

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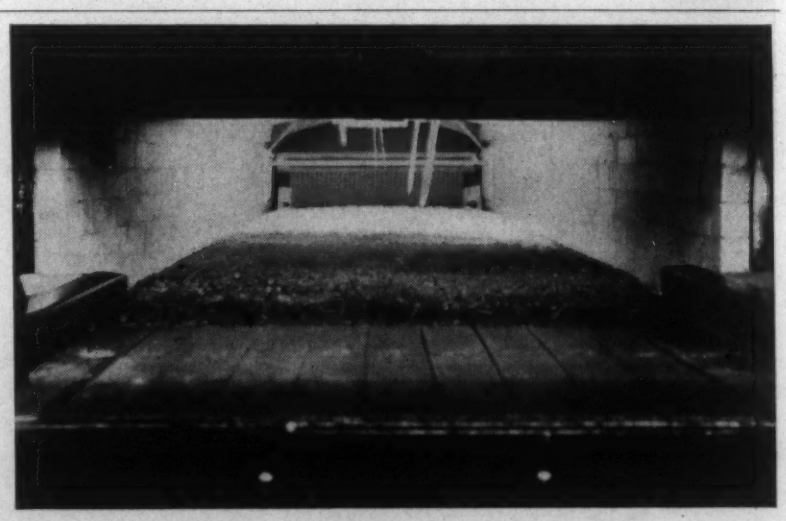

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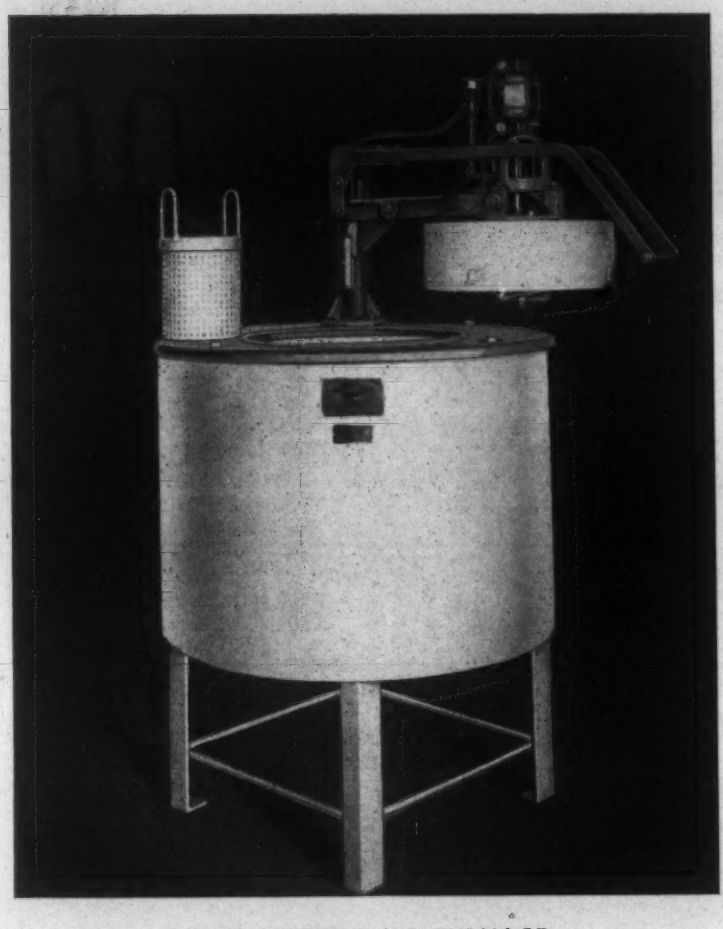

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pendent of the C content of the metal and (b) increases linearly with the total pressure for a constant ratio $\frac{P_{CO_2}}{P_{CO}}$. Carburization or decarburization velocities may be expressed as

$$\frac{dc}{dt} = \left\{ K_1 P_{CO_2} - K_2 \frac{P_{CO_2}}{P_{CO}} \left\{ 1 - \frac{C_e}{C} \right\} \right.$$

where $K_1$ and $K_2$ are graphically determined velocity constants while $C_e$ and C are the C concentrations in the metal at the end and at time t. The P's are partial pressures of $CO_2$ and CO. From the first parenthesis it may be seen that the reaction

$$CO_2 \text{ (gas)} \rightleftarrows CO + O \text{ (adsorbed)}$$

determines the velocity of the process, while the reaction

$$O \text{ (adsorbed)} + C \rightleftarrows CO$$

is essentially in equilibrium. Values of 0.078, 0.155 and 0.308 for the $\frac{CO_2}{CO}$ ratio were employed. These corresponded to solubilities of 0.42, 0.20 and 0.087 g. C/100 g. Fe. Carbides do not precipitate at these temperatures until a solubility of C in Fe of 1 g./100 g. is attained. As the solubilities of C in Co and Ni at these temperatures are smaller than for Fe, $CO_2/CO$ ratios of 0.036, 0.082 and 0.108 were used for these metals. It is found that plots of $\frac{dc}{dt}$ vs. reaction pressure for Co and Ni were similar to those for Fe and the curves for all 3 metals may be similarly expressed. Interestingly enough, different carburization rates may be found for 2 samples of Fe otherwise considered to be identical.

HAS (5e)

## 5f. Nitriding

**The Nitriding of Alloy Tool Steels.** V. O. HOMERBERG. *Industrial Heating,* Vol. 3, Oct. 1936, pages 631-636. Although nitriding steels can be treated so as to obtain a very hard surface the core is often too soft for many purposes. Alloying can remedy this; e.g. a steel of 0.77% C, 0.24% Mn, 3.3% Cr, 8.63% Mo, 1.35% W and 1.01% V showed not only good surface hardness but satisfactory core properties. Other compositions, and the required heat treatment in nitriding and testing methods described. 5 references. Ha (5f)

**Note on the Mechanism of Nitriding of Steels (Notiz zur Frage nach dem Mechanismus der Nitrierung von Stählen)** A. SCHECHTER. *Acta Physicochimica USSR,* Vol. 4, No. 5, 1936, pages 767-774. In German. Nitriding experiments with activated N did not lead to any noticeable nitrided layer at 550° C. even after 12 hrs. exposure. The reaction $N + 4\,Fe = Fe_4N$ apparently did not prevail, but the following "parasitic" reactions representing the denitriding action of active N and the recombination of the N-atoms predominated:

$$N + Fe_4N = 4\,Fe + N_2 + 100{,}000 \text{ cal.}$$
$$N + N \rightleftarrows N_2 - 160{,}000 \text{ cal.}$$

EF (5f)

**Electrically Heated Nitriding Furnaces for Surface Hardening of Steel (Elektrischgeheizte Nitrierofen zur Oberflächenhärtung von Stahl)** H. ZERPUER. *Electrotechnische Zeitschrift,* Vol. 57, Mar. 19, 1936, pages 326-327. Surface hardening by passing $NH_3$ at 500° C. is described. A hardness of 900 Br. has been attained. Ha (5f)

**Thermal Dissociation of Simple and Complex Cyanide with Formation of Alkaline Metals, Particularly of Potassium (Thermischer Zerfall einfacher und komplexer Cyanide unter Bildung von Alkalimetallen, besonders von Kalium)** B. ORMONT & B. A. PETROW. *Sitzungsberichte der Akademie der Wissenschaften in Wien. Mathematisch-Naturwissenschaftliche Klasse, Abt. IIb, Chemie,* Vol. 145, No. 5, 1936, pages 391-407. The K yield from the dissociation of KCN is relatively great and may amount to 80% of the theoretical value. The dissociation of $K_4Fe(CN)_6$ and KCN was studied in small laboratory furnaces which yielded pure K. Only small amounts of Li could be obtained by thermal dissociation of $Li_4Fe(CN)_6$. Using a mixture of Na and K cyanide, a K-Na alloy was obtained which distilled as large silvery drops and stayed liquid at room temperature. The reaction velocity in the system NaCN-KCN-Fe is no smaller than that in the system KCN-Fe. The constitutional diagram Fe-N is briefly discussed. Fe catalytically accelerates the decomposition of KCN, a stable nitride or a solid solution of N in Fe which retards the reaction being formed. At least 2 nitrides ($NFe_2$ and $NFe_4$) occur at low temperatures, and there are 2 solid solutions i.e. of N in α and γ-Fe above 600° C. Conditions become much more complicated in the presence of C. WH (5f)

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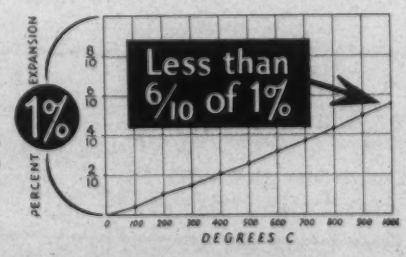


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# 6. FURNACES, REFRACTORIES AND FUELS

M. H. MAWHINNEY, SECTION EDITOR

**Open-Hearth Stainless Steel.** SAM TOUR & T. W. LIPPERT. *Iron Age,* Vol. 138, Sept. 17, 1936, pages 56-61, 119. Stainless steels have mostly been made in the electric furnace because it has been better able to cope with the peculiar reactions of Cr at steel making temperatures. The use of open-hearth furnace for stainless steel making will show a fuel saving, and also large tonnage heats are more practicable. Describes 2 types of open-hearths for stainless steels; the K. M. Simpson and the E. Bosshardt furnaces. The Simpson furnace follows a conventional construction pattern, the only exception being in the use of multi-flames of fuel oil or coke gas whereby a considerable amount of fuel can be burned in a small space and in a short time. Result claimed is efficient heating at high temperature with minimum destruction of roof refractories. The Bosshardt furnace, of German origin, can make excellent stainless steel from scrap without imposing an excessive thermal load on roof. Analysis of steel is highly satisfactory. Gives operating data of a unit of Barium Steel Corp. VSP (6)

**Rose Movable Ports.** E. L. RAMSEY. *Blast Furnace & Steel Plant,* Vol. 24, July 1936, page 611; Aug. 1936, page 699. Paper read before the Open-Hearth Committee of the American Institute of Mining & Metallurgical Engineers. Gives experience at Wisconsin Steel Co. There are 7 120-ton basic open-hearth furnaces equipped with movable ports for firing mixed gas. Mixture comprises 2.5 parts blast-furnace gas to 1 part coke-oven gas with a heat value of 230 B.t.u./ft.$^3$, which is burned through a nose of the port of 3.54 ft.$^2$ These ports permit absolute control of flame velocity and direction, resulting in improved operating conditions, longer furnace campaign, lower fuel consumption, and lower running repair costs, compared with other fuel. Port in "in" position is firing while port at other end of furnace is "out," giving an open-end furnace and greatly reducing waste-gas velocity and burning out of end panels and division walls. MS (6)

**Economic Importance of Insulating Refractories.** J. G. COUTANT. *Industrial Heating,* Vol. 3, Oct. 1936, pages 695-698, 726. The properties of modern insulating refractories are described and the economic advantages accruing from their application as furnace lining materials explained. As their weight is much less than that of firebrick or similar materials, the heat stored is reduced considerably and the fuel is utilized to a much higher degree. Actual savings, and rates of furnace outputs are shown by examples. Ha (6)

**The Selection of Industrial Ovens.** R. BYRON. *Industrial Heating,* Vol. 3, Sept. 1936, pages 593-595; Oct. 1936, pages 707-708, 716; Nov. 1936, pages 785-788. The factors involved in selecting an industrial furnace for a given production and a given material are discussed at length; the principal factors are furnace construction, method of heating and material handling. Ha (6)

**The Use of Fire Cements in Industry.** W. O. LAKE. *Sands, Clays & Minerals,* Vol. 3, Nov. 1936, pages 51-52. The uses of cement in metallurgical processes are considered in 3 groups. 1. Highest temperatures, 1600°-1700° C. Magnesite bricks or tamped dolomite are used for the bottoms of such furnaces, and finely ground silica cement, high in $SiO_2$, bonded with milk of lime, for joints. $Al_2O_3$ refractories with 70-80% $Al_2O_3$ are employed in oil-fired basic furnaces, joined with high $Al_2O_3$ cement. 2. Temperatures from 1400°-1600° C., in blast furnaces, foundry cupolas, etc. Silico-alumina bricks of 30-35% $Al_2O_3$ are used, preferably with a cement of the same type. 3. Furnaces, stoves, etc. for 800°-1400° C. No special refractories and cements need be applied but they should be appropriate for the specific purpose. Ha (6)

**Recuperators for Industrial Furnaces.** W. TRINKS. *Industrial Heating,* Vol. 3, Oct. 1936, pages 637-638. The economic importance of recuperators in conjunction with industrial furnaces is discussed and suggestions are offered regarding locations and furnace equipment to derive maximum benefit from installation of a recuperator. Ha (6)

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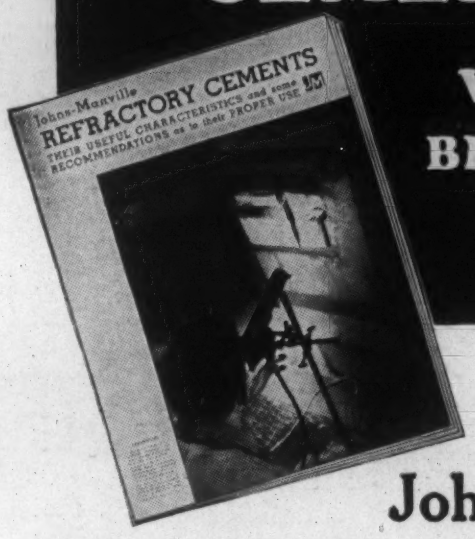


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# 7. JOINING

## 7a. Soldering & Brazing

C. H. CHATFIELD, SECTION EDITOR

**Electric Furnace Brazing—A New Method of Fabrication.** A. G. ROBIETTE. *Metal Industry,* London, Vol. 48, Jan. 24, 1936, pages 131-135; Jan. 31, 1936, pages 157-159. While considerable development has taken place in other branches of metallurgy, the time-honored method of using a torch or blowpipe is still the preferred practice for brazing or soldering metallic surfaces. The inherent shortcomings of this method are commented upon. A comparative recent development, electric furnace brazing, is now coming into more general use. This is a process which was of little commercial importance, due to difficulties of producing cheap atmospheres and plant equipment to withstand high temperatures, until 1925 when an American industrial concern realized its possibilities for some special work and developed it as "copper brazing" in an atmosphere of H. Even then the cost of the process was so high that production was limited. Recent developments have reduced the cost and increased the scope of the process. Research is still in progress in an endeavor to still further reduce the cost of the process. The process is briefly described in a broad general manner. Factors that must be considered are (1) methods of assembly of the parts to be brazed, (2) methods of application of the brazing medium, (3) the surface tension of the molten brazing alloy, which must wet the material to be joined, (4) extraneous substances as oil, dirt, or oxide film must be absent, and (5) the atmosphere employed must be neutral or reducing to the material to be brazed. The range of metals to which this process can be applied is constantly expanding as more knowledge is obtained concerning the properties of different joining alloys. The metals that have been successfully brazed by this process are discussed. Difficulties are encountered in the use of the process for non-ferrous alloys which are not found in the ferrous alloys due to "gassing" caused by the reduction atmosphere. By the use of "silfos" and high grade silver solders brass has been brazed successfully. The process has not, as yet, been used successfully in the joining of Al and its alloys. It has, however, been successfully used in joining Ni and its alloys. The strength and characteristics of these joints are discussed. Advantages claimed for the process are (1) it will produce a stronger joint, (2) the work is generally produced with a bright finish which may be plated without further treatment, (3) only a minimum of the brazing alloy is required, (4) several joints may be produced at the same time with a minimum of distortion, (5) no strains are produced through localized heating, (6) it makes possible the economic fabrication of complicated and expensive assemblies from comparatively cheap pressings or stampings. A number of examples of commercial applications are considered. These include refrigerator parts and accessories for motor cars. The cost of brazing and the controlled atmospheres now being used are described. The type of furnace used is discussed. The article is well illustrated. HBG (7a)

**Fluxes for Use in Soft-soldering.** J. W. WILLSTROP, A. J. SIDERY & H. SUTTON. *Journal Institute of Metals,* Vol. 59, Apr. 1936, pages 175-180 (Advance Copy No. 732). An examination was made of the soft soldering of materials that are not easily soldered with the aid of the usual fluxes, particular attention being paid to the soldering of stainless steel and to the corrosive effect of flux residues. The effectiveness of ortho-phosphoric acid as a flux and the properties of fluxes containing organic phosphates as the active agents were investigated. Fluxes based on organic phosphates permit easy soldering of many materials without residues of fluxes causing corrosion. The fluxes may be used satisfactorily on corrosion-resisting steels and other materials not readily soldered with the use of fluxes containing $ZnCl_2$ as the active constituent. JLG (7a)

**Big but Perfect.** G. W. IRWIN. *Industry & Welding,* Vol. 8, Apr. 1936, pages 24-25. Large rock crusher is repaired by braze welding. See "Broken Shaft of Large Rock Crusher Salvaged by Braze Welding," *Metals and Alloys,* Vol. 7, Sept. 1936, page MA 449L/7. WB (7a)

**Saving of Tin in Soft-soldering (Die Einsparung von Zinn beim Weichlöten)** E. LÜDER. *Zeitschrift Verein deutscher Ingenieure,* Vol. 80, May 23, 1936, pages 655-656. See *Metals and Alloys,* Vol. 7, Oct. 1936, page MA 498L/2. Ha (7a)

**A New Soaking Pit.** H. F. SPENCER & C. F. HERINGTON. *Iron Age,* Vol. 138, Dec. 3, 1936, pages 47-51, 130. Describes a patented soaking pit developed by Amsler-Morton Co., which (1) is extremely simple; (2) is adaptable to any fuel or fuel mixture and minimum consumption thereof; (3) has an effective, durable and inexpensive recuperator; (4) eliminates the destruction of original scale; (5) is automatically controlled; (6) is continuously fired with controlled atmosphere; and (7) develops uniform grain structure. It is commercially known as "Amco." Includes 2 tables which show fuel consumption on both hot and cold heats and comparative data on the making of bottom in Amco unit and in other types. VSP (6)

**The Refractory Clays (Les Pisés Réfractories)** MUGNEROT *Revue de Fonderie Moderne,* Vol. 30, Dec. 10, 1936, pages 335-340. Refractory clays are preferably quartz materials reduced to sand and with a slight percentage of ordinary clay. They are excellent lining materials for electric furnaces as with 92-94% $SiO_2$ the melting point is 1770° C.; the softening point is very close to the melting point. With up to 6% $Al_2O_3$ the melting point is lowered but beyond this and up to 9.2% $Al_2O_3$ the melting point rises again and approaches 1790°-1810° C. The composition of the deposits found in France and Germany are given. Bricks are also made of this material, but they are very expensive. Ha (6)

**Electric Furnaces for Porcelain Enameling.** K. E. KJOLSETH. *General Electric Review,* Vol. 39, Oct. 1936, pages 479-486. Requirements in the enameling operation are: (1) a consistently high-quality product with a minimum of rejects, (2) assured continuity of operation, (3) low operating cost and low maintenance cost and (4) flexibility to meet varying operating conditions. Box, continuous, and semi-continuous electric furnaces used are described. Continuous furnace operating data are presented and power cost comparisons are made. Atmosphere in furnace is not contaminated with other gases and thus offers another advantage. CBJ (6)

**Modern Electric Steel Plant of Roumanian Oil Company "Concordia" (L'aciérie électrique moderne de la société pétrolifère roumaine "Concordia")** R. SEVIN. *Journal du Four Electrique,* Vol. 45, Nov. 1936, pages 383-388. Description of the plant containing two Heroult furnaces with total capacity of 3.5 tons. JDG (6)

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*"In electrodes as in drinks, it's the analysis that ofttimes brings on the 'headache'!"*

*"Blends that leave the* MAURATH *warehouse are thoroughly tested. Each analysis guaranteed to make a potent bond."*

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BUILDER OF BETTER WELDING ELECTRODES IN ALL ANALYSES

**When and How Silver Solders Are Used.** R. H. LEACH. *Welding Journal N. Y.*, Vol. 15, Oct. 1936, pages 41-44. Broad outline of general character of Ag solders given to indicate conditions for which they would be preferred to other types of brazing alloys. The methods of application, temperatures, fluxes, manipulation are outlined. Character and properties of the joints are discussed. WB (7a)

1

**Physical Properties of Soft Solders and the Strength of Soldered Joints.** B. W. GONSER & C. M. HEATH. *Metals Technology,* Aug. 1936, *American Institute Mining & Metallurgical Engineers, Technical Publication* No. 727, 23 pages; *Iron Age,* Vol. 137, Feb. 27, 1936, pages 30-33. Comparison of joint strengths and physical properties were made among 4 types of soft solders of commercial importance, selected according to their method of manufacture. These were virgin Pb and Sn, secondary solder, electro-refined crude solder with Straits Sn added in high-Sn solders, and electro-refined solder adjusted with Chinese Sn. Not much practical difference was found in the properties. Fire-refined secondary solder containing 2 oz./ton Ag gave somewhat the strongest joints with less porosity in the most-used compositions. The making of lap joints by flowing solder into a wide space and then forcing the joint members together while the solder was still molten gave the best joints. All solders gave about a 5% increase in electric conductivity on aging at room temperature for 6 or 8 months. The relatively impure solders were slightly stronger in both tensile and shearing strength. JLG + VSP (7a)

2

## 7b. Welding & Cutting

E. V. DAVID, SECTION EDITOR

**Riveting Hammer Proves Value as Welding Tool.** A. M. MACFARLAND. *The Welding Engineer,* Vol. 21, Oct. 1936, pages 23-24. Spot, pressure and flash welds are shown to be possible with hammer. WB (7b)

3

**Obtaining Sound Welds of Neat Appearance.** J. E. MINTY. *Welding Engineer,* Vol. 21, July 1936, pages 29-32. Coated rod is favored for all welding. Good appearance in weld is considered possible only when weld is positioned. Welding rods are classified by the company's testing methods into those favored for certain positions and those with greater or less splatter. Welder himself is required to scrape and brush own welds since it was found that helper was not as critical of optimum cleaning, the cleaning operation by welder also makes him inspect quality of his own welds. Structures are fabricated by flame cutting shapes and welding; illustrations are given. The a.c. arc is favored for this construction because of speed, lack of blow and less splatter. WB (7b)

4

**Methods of Lead Welding.** F. E. ROGERS & W. H. CARTER. *The Welding Engineer,* Vol. 21, Aug. 1936, pages 24-27. Chemical lead sheet is welded for tank linings, etc. where corrosion resistance is required. Torch supplied with city gas and $O_2$. Procedure is outlined and illustrated for lead sheet and piping. WB (7b)

5

**Conditions under Which Autogenous Welding Is Being Developed in Egypt.** MOHAMED EL-DIB. *Welding Journal (London),* Vol. 33, July-Aug. 1936, pages 210-212. (Read at 12th International Congress Acetylene, Oxy-Acetylene Welding and Allied Industries, London 1936.). Rapid growth of welding due to establishment of manufacturing industries in former agricultural region and state regulation for maintenance of standards and reducing hazards of torch welding for untrained manufacturing staff are discussed. Welding is taught in 14 state or municipal industrial schools and 9 private schools. WB (7b)

6

**Oxyacetylene Welding of Copper-Nickel Alloys.** I. T. HOOK. *Industry and Welding,* No. 9, Dec. 1936, pages 62-64 (presented at 37th International Acetylene Assn. convention). Ni content of the alloys presents difficulties due to adherent, refractory oxide which causes surface of weld metal to be rough. Ni also sensitive to absorption of $H_2S$ from welding flame and flame should be so adjusted as to prevent burning out Mg or Mn which protect the alloy from S absorption. Wide use of jigs recommended for greatest economy. Procedure for welding given and precautions against puddling to be taken to prevent burning out deoxidizers, a weak flame with slight excess of acetylene is recommended rather than neutral flame. Use of Si in rod, aids formation of a continuous fluid protective film on the weld pool which protects deoxidizers and prevents gas absorption by Ni. Usual fluxes containing borax are described as suitable for Cu-Ni. WB (7b)

7

**Resistance Welding of Dissimilar Metals.** R. T. GILLETTE. *Welding Journal, N. Y.*, Vol. 15, Oct. 1936, pages 45-48. The problems in this field are requirements as to variable time, pressure, energy and resistance of parts which are common to all resistance welding. The character of the alloy formed is also a problem which is taken care of in the case of formation of brittle alloy by adjusting pressure, energy and contact area to form the alloy and extrude it out of the joint at high speed. Properties of the joints are discussed and illustrated and fully automatic machines for various operations shown in photos. Conclusion is that any combination of metals or alloys can be welded by resistance method provided the proper combinations of factors that control the particular weld to be made can be found. WB (7b)

8

**Stainless Steels: Properties, Applications, Welding Procedure.** *The Welding Engineer,* Vol. 21, Oct. 1936, pages 31-33. Reprinted from 4th ed. of Procedure Handbook of Arc Welding, Lincoln Electric Co. WB (7b)

9

**A Welded Reaction Chamber.** *The Welder,* Vol. 8, Sept. 1936, pages 1073-1075. Further details are given of the method of making inside and outside welds in attaching nozzles to reaction chamber. Preheating of the base metals by means of a ring of gas jets was used to prevent drastic quench by heavy wall (6-⅜" thick) of reaction chamber. The circumferential weld was made in steps of short weld sections at 120° to each other and intervening sections then filled in by welding in order to prevent stress concentration. WB (7b)

10

**Welding Pipe Lines in the Power Plant.** *Power Plant Engineering,* Vol. 40, Oct. 1936, pages 586-587. Discussion and sketches showing how electric welds were made on 475 lb. steam pressure pipes. Circumferential welds made on location were built up so as to anneal the weld and the pipe metal adjacent to it. ECK (7b)

11

**Tentative Rules for the Qualification of Welding Process and Testing of Welding Operators.** *Welding Journal, N. Y.,* Vol. 15, Oct. 1936, Supplement pages 33-42. **Standard Welding Operators' Tests Formulated.** *Industry & Welding,* Vol. 9, Nov. 1936, pages 15-22. Published for the purpose of eliciting comments, criticisms and suggestions. The various qualifying tests are given and discussed in detail. WB (7b)

12

**Welding High Alloy Castings.** F. K. ZIEGLER & L. B. HAUGHWOUT. *Metal Progress,* Vol. 30, Oct. 1936, pages 195-198, 200. Data are presented to show that welding of high Ni-Cr alloys is feasible on new castings and for repairing existing installations without impairing their life. Micrographs show that satisfactory welds can be made to carburized alloy with low carbon material. X-Rays are useful in evaluating condition of castings (new) on which repairs are to be made and in diagnosing the soundness of welds. WLC (7b)

13

**"Blow, Wind, Blow"—Brought Up to Date.** M. S. KICE, JR. *Industry and Welding. Third Quarter,* 1936, pages 96-98. Use of welded rolled steel plate for stators, pedestals and bed plates for large size blowers is discussed and illustrated. WB (7b)

14

**Automatic Carbon-Arc Welding in Steel-Construction (Die automatische Kohlelichtbogenschweissung im Stahlbau)** W. GIUDICE. *Elektroschweissung,* Vol. 7, Oct. 1936, pages 189-192. Today the C-arc welds are more economical than metal-arc welds, especially with automatic installation for heavy and long seams. High quality of the welds was reached after adding alloying elements to the paste. Workshop practice is given with containers up to 3200 mm. diameter and girders. HR (7b)

15

**Varied Welding Operations Assist Production of Motor Trucks.** FRED B. JACOBS. *Steel,* Vol. 99, July 13, 1936, pages 32-34. Outlines and illustrates some of the welding practice of the White Motor Co., Cleveland, O. Both gas and electric welding are used. Natural-gas is used in combination with $C_2H_2$. MS (7b)

16

**Decreasing the Respiratory Hazard in Welding.** A. D. BRANDT. *The Welding Engineer,* Vol. 21, Aug. 1936, pages 21-23. Discussion of toxic gases, fume and smoke given off in welding operations on different metals and methods of preventing injury to respiratory tract of welder by means of various types of masks. WB (7b)

17

**Electric Heating by the Proximity Effect.** EDWARD BENNETT. *Welding Journal, N. Y.,* Vol. 15, Oct. 1936, Supplement pages 16-20. Theoretical discussion of induction heating at high frequency using the work as secondary and heating locally at areas where welds are to be made. Application considered to be welding of thin sheet or strip. WB (7b)

18

*Brazing thin copper tubing to bronze headers with SIL-FOS in the construction of McCord Radiator & Mfg. Co. Unit Heaters.*

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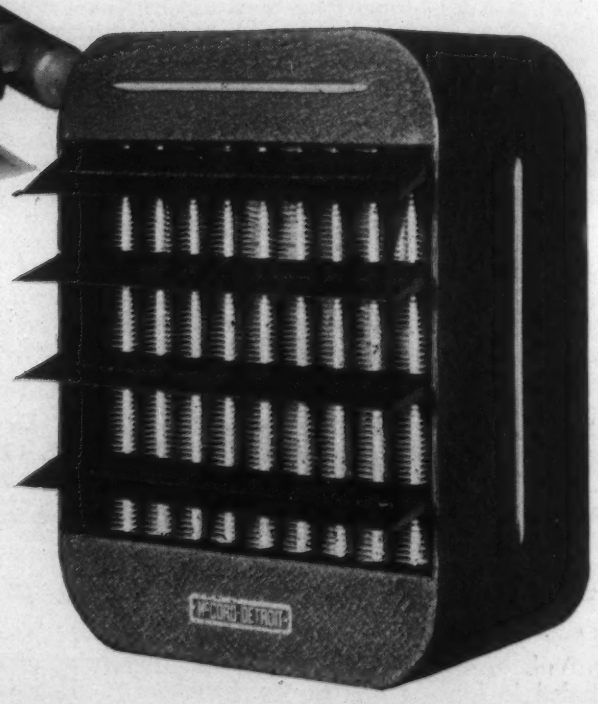
## *gives* life-time strength *to heating elements in unit heaters*



**The heating element is the very heart of a unit heater. The joints between the tubing and headers or return bends used in constructing them must be permanently tight. To assure this and the trouble-free operation which results, McCord and other well known makers use SIL-FOS . . . because**

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- **Ductile SIL-FOS joints stand up reliably under wide temperature changes and constant vibration.**
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- **SIL-FOS assures economy—a small quantity does a perfect job . . . the low brazing temperature saves time, gases and speeds up production.**

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***Use it with our low temperature Handy Flux. Together they work equally well on thin or heavy gauges, on production or special work. Write us for full details and* BULLETIN 53MA.**

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**Five Years' Experience with Bronze Welded Machinery.** J. C. CARTER. *Industry and Welding,* Vol. 9, Oct. 1936, pages 34-39. Details of repairs on ferrous cast structures by means of preheat and bronze gas welding. Permanence of structure after repairing stressed. WB (7b)

**Combining Steel Castings and Plate Economically.** HAROLD F. FALK. *The Welding Engineer,* Vol. 21, Sept. 1936, pages 42-45. Cost analyses are shown as criteria of choice between welding or casting. Where bearing block unit is massive and required in units of less than 6 welding has the advantage; above 6 units castings are lower cost. Photos of some of the large cast-weld units produced are given. Weight of castings vs. welds, machining costs of castings for finished parts vs. little or no machining for welds are also considered. WB (7b)

**The Effect of Low Temperature on the Tensile Impact Resistance of Iron, Steel and Welded Joints.** OTTO H. HENRY. *Welding Journal, N. Y.,* Vol. 15, Oct. 1936. Supplement pages 2-9. Results are discussed from large amount of data presented in numerous curves and tables for tensile impact properties of as-welded Armco, 0.25 C, 0.85 C and 18-8 steel arc and gas welded and brazed under various conditions. Tests were made at room temp. down to —80° C. No relation evident between notch impact values of welds and tensile impact. Bibliography. WB (7b)

**Casting-Welding Composites Are Complementary.** FRED GROTTS. *Industry and Welding. Third Quarter,* 1936, pages 92-95. Steel castings of high mechanical properties obtained by cutting risers, etc. off with torch, annealing casting at 1650° F. quenching in hot water and draw at 1250° F. are compared with same structure built up by welding higher strength steel equivalent to steel castings properties. Such construction favors steel castings with 92,000 tensile, 61,000 yield, 26% elongation, 56% reduction of area and 52 ft. lbs. Izod. The fillet welded Tee construction is compared with Tee angle casting. The latter is considered of higher strength because no discontinuity exists such as at the bottom of the Tee in double fillet weld. Photo-elastic studies of stress distribution for both cases are illustrated. The use of castings and welded rolled sections in combination is urged for high strength and lightness. WB (7b)

**A New Principle in the Practical Training of Oxyacetylene Welders.** R. GRANJON. *The Welding Engineer,* Vol. 21, Oct. 1936, pages 42-43. Paper at 12th International Congress of Acetylene, Oxy-Acetylene Welding and Allied Industries, London, June 1936. WB (7b)

**Recent Practice in Fusion Welded Boiler Drums.** D. S. JACOBUS. *Welding Journal N. Y.,* Vol. 15, Oct. 1936, pages 56-57. Review of progress made in welding due to increased confidence resulting from X-ray inspection of seams and trend toward use of higher strength plate requiring welds of reduced thickness. Code requirements as to stress relief is in interest of increased safety of performance in service. WB (7b)

**How Typical Welding Tests Are Made.** *Industry and Welding,* Vol. 9, Oct. 1936, pages 49-53. (Preprint of chapter to be included in Lincoln Electric Co. handbook). Details of tests and test piece preparation are reviewed for tensile, free bend, nick-break, impact and fatigue tests. WB (7b)

**Kelvinator Adopts All Welded Construction on Cabinets.** *Iron age,* Vol. 138, Sept. 3, 1936, pages 40-45. Describes methods of welding adopted by Kelvinator Corp. in the manufacture of Kelvinator and Leonard cabinets for refrigerators. The end panel stampings are flash welded to top panel, front center cross panel is projection welded in place, and panel is spot welded to the shell. The base panel is gun welded to bottom flanges of upper shell. This method is used for "K" type refrigerators. Other types use projection welding instead of spot. VSP (7b)

**Abstracts of Papers of American Welding Society at Cleveland Meeting, Oct. 1936.** *The Welding Engineer,* Vol. 21 Sept. 1936, pages 37-40. WB (7b)

**Formation of Metallic Nitrides in the Welding of Steels.** A. PORTEVIN & D. SÉFÉRAIM. *The Industrial Chemist,* Vol. 12, July 1936, pages 317-318. Abstract of a paper read before the International Acetylene Congress. RAW (7b)

**Evolution of a Welding Rod.** F. L. PRENTISS. *Iron Age,* Vol. 138, Dec. 3, 1936, pages 40-42, 120-121. Describes manufacturing procedure of the Maurath, Inc., Cleveland, specializing in alloy welding wire for joining corrosion, heat resisting and stainless products. They are made in 16 analyses, in sizes from 5/64 in. to 3/16 in. in diameter. Unique feature of plant is that radio entertainment is provided for the employees. VSP (7b)

**Subsequently-treated Gas Fusion Welding (Nachbehandelte Gasschmelzschweissung)** A. MATTING & H. OTTE. *Autogene Metallbearbeitung,* Vol. 29, Oct. 1, 1936, pages 289-295. Welded joints of (German) steel ST 37 of different thicknesses were tested and the influence of different welding procedures on structure determined. Found that cold-bending test does not give reliable results with regard to quality of high-grade welds, but the quench-bending test shows differences in the deformability of welds very well. Notch-impact toughness of an autogenous weld can be improved by proper heat treatment and mechanical treatment or by alloying additions. Welding in several layers is better done with coated electrodes. An autogenous weld is endangered more by aging than an electric welded seam. Impact-tensile test cannot be recommended as test for welded joints. Fatigue bending and tensile tests can be used for judging highly stressed welds. 19 references. Ha (7b)

**Comparison between Oxy-Acetylene and Electric Arc Welding.** M. L. MESLIER. *The Industrial Chemist,* Vol. 12, July, 1936, pages 316-317. An abstract of a paper read before the International Acetylene Congress. RAW (7b)

**Welding in Cast Iron Structures.** T. S. QUINN & JOHN HOWE HALL. *Industry & Welding,* Vol. 8, Aug. 1936, pages 21-27. See "Combining Castings and Weldings," *Metals and Alloys,* Vol. 7, Dec. 1936, page MA 588L/7. WB (7b)

**Fundamentals of Joint Design for Welding Piping Systems.** S. C. CLARK. *Heating, Piping & Air Conditioning,* Vol. 8, Oct. 1936, pages 552-555. Butt type welds, inside and outside corner welds and fillet welds are discussed. CBJ (7b)

**The Welded Ship (La Nave saldata)** U. GUERRERA. *Industria Meccanica,* Vol. 18, Sept. 1936, pages 561-565. Examples of welded structures and welding methods employed in the Italian navy and merchant marine described. Ha (7b)

**The Position of Investigation of Welding in Steel Construction (Stand der Versuchsforschung im Stahlbau auf dem Gebiete der Schweisstechnik)** K. KLÖPPEL. *Elektroschweissung,* Vol. 7, Oct. 1936, pages 182-184. Condensed survey of investigations directed by the German Committee for Steel Construction. HR (7b)

**Hard-Facing Helps to Keep New Equipment Productive.** E. E. LE VAN. *Steel,* Vol. 99, July 27, 1936, page 52. Actual wearing surfaces of equipment can be protected against abrasion by hard-facing. Depending upon type of hard-facing material used, these parts outlast steel from 3 to 10 or more times, thus assuring more continuous production and operation of expensive equipment. Gives examples of applications of hard facing in steel plants and results achieved. MS (7b)

**Many-sided Application of Steel Pipe by Oxy-acetylene Welding (Vielseitige Verwendung des Stahlrohres durch die Azetylenschweissung)** J. J. THIESSEN. *Autogene Metallbearbeitung,* Vol. 29, Oct. 1, 1936, pages 296-297. A number of examples illustrate structures built up by welding of pipes, as railings, gates, doors, etc. Ha (7b)

**Stresses in Welded Pipe Relieved by Low-Frequency Heat Coil.** C. M. WEINHEIMER. *Steel,* Vol. 99, Sept. 14, 1936, pages 60. Describes device developed by Detroit Electric Furnace Co. Consists of a portable, low-frequency heating coil and protective insulating shield, both hinged so that they are readily clamped around pipe weld. Tap change transformer and control equipment are mounted on a hand truck. Primary cable is connected to any 60-cycle power supply of about 100 kva. capacity. Thermocouple is attached to weld and to controller. Coil is mounted around weld and secondary cables are connected to coil. Correct voltages for proper heating rate are secured by making proper connections on tap changer. MS (7b)

**Welding Stainless Food Manufacturing Equipment.** GEORGE H. TAY. *Industry & Welding,* Vol. 8, July 1936, pages 53-56, 64. See "Welded Stainless Equipment," *Metals and Alloys,* Vol. 7, Dec. 1936, page MA 590R/7. WB (7b)

**Annealing and Forging Performed on Standard Resistance Welders.** R. L. BRIGGS. *Iron Age,* Vol. 138, July 23, 1936, pages 20-21. Resistance welders can be adapted by few changes to heat and bend stock forgings into various shapes, continuous heating of tubing and heating and pulling wire apart. Another application of resistance heating is for annealing parts, particularly when area to be annealed is limited to section of whole piece. Operation is done on spot welder fitted with a simple fixture. Shaping metal by upset heating in a butt welder also has possibilities. A typical application is in production of automobile valves. VSP (7b)

**Autogenous Welding of Gasometer Bells (Autogene Schweissung von Gasometerglocken)** O. SCHUCH. *Autogene Metallbearbeitung,* Vol. 29, Sept. 15, 1936, pages 279-282. The difficulties of welding together sheets forming the bell of large gasometer tanks are due to their thinness compared with the dimensions of the gasometer; as warping and deformation must be avoided they were mostly riveted. The procedure adopted in welding a gasometer for 500 m.$^3$ of 11.8 m. dia., 4.8 m. height of the cylindrical part of the bell and 600 mm. height of the arched top of the bell, of sheets of 3 mm. thickness, is described in detail and the progressive steps are illustrated. The sheets were buttwelded with retrogressive welding by a 2-flame torch in horizontal seams and a 1-flame burner in vertical seams. Ha (7b)

**On Gases and Blowholes in Welds (Ueber Gase und Gasblasenbildung beim Schweissen)** H. BLOMBERG. *Elektroschweissung,* Vol. 7, July 1936, pages 121-128. A survey on the causes and the mechanism of the formation of blowholes in welds shows them to be governed by the same principles as in melting and casting practice. Blowholes are diminished by retarded cooling i.e., a slag cover, and by addition of Al, Si or Mn. HR (7b)

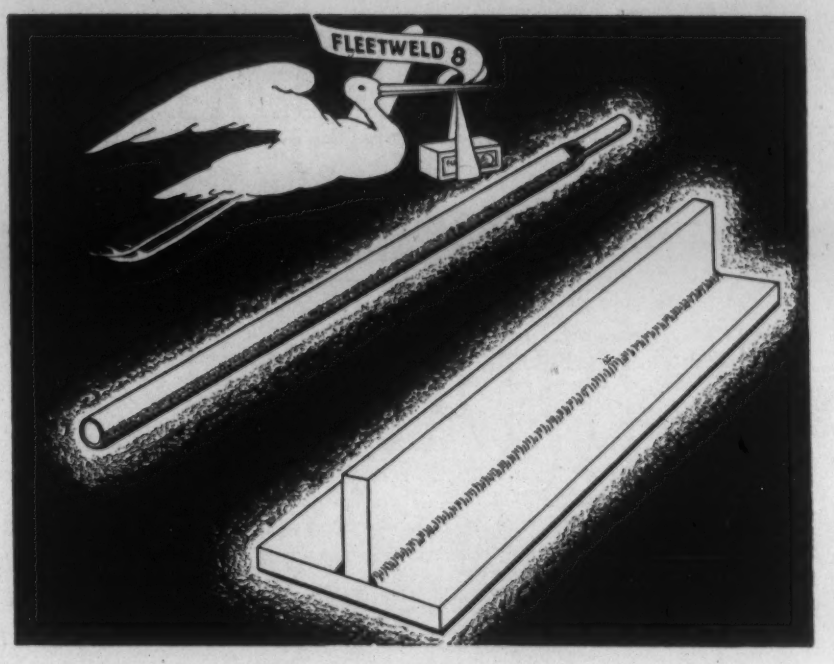
**Electric Arc Welding and Its Applications—XIV. (Conclusion).** M. MAURICE LEBRUN. *Welding Journal (London),* Vol. 33, July-Aug. 1936, pages 198-200, 218. Repair of crack in rolling mill frame is described. Frame was of cast Fe and crack welded by studding chamfered sections across the crack and laying down a deposit. Further reenforcement was obtained by welding circular discs across the crack on all sides in order to allow welded-on pieces to take the load across the crack. Other repair jobs are described, for cast automotive cylinder blocks and bridge reconstruction where added reenforcement for concrete is obtained by welding bosses or bars to the usual reenforcing bars. WB (7b)

**Arc Welding of Structural Alloy Steels.** W. L. WARNER. *Welding Journal, N. Y.,* Vol. 15, Oct. 1936, pages 21-32. *Industry and Welding,* Vol. 9, Oct. 1936, pages 60-64 (to be continued in later issues of *Industry and Welding).* Results reported for investigation of hardness (Vickers-Brinell) produced in heat-affected zone of parent metal due to a weld bead run over the surface of flat plates. The effect of C and Ni on hardenability is shown by results given in tables; hardness contours, progressively across the weld and heat disturbed area are indicated in tables, graphs and curves. The effect of C and Ni and other alloys on tensile, yield strength, ductility, tensile impact of butt welded plates of C, Ni and other high tensile, low alloy welding steels are detailed in graphs and tables. Low temperature tensile impact tests from room temperature down to —100° F. are reported for butt welded plain C and structural Ni steels and on the stress relieved parent plate material. A few results are given of high velocity impact tests on various as rolled and stress relieved samples of unwelded parent metal. The indications are that steels for welding are most sensitive to C content; Ni contents intensify the sensitivity, but when present with low or lower C there is either no increased hardening or it is slight. Limiting C to .25% is considered to allow steels with alloy contents to be safely welded without cracking or producing extreme hardness in heat disturbed zone. From the assumption that the max. hardness of the heat affected zone is an index of the weldability of the steel plate a tentative order of acceptability for welding is given for various compositions of steel plate ranging from tensile strength of 95,000 and over down to 60,000-75,000 and proportional limits ranging from 55,000 and over down to 35,000-40,000. WB (7b)

**Welding High Strength Plain Carbon Steels (Schweissen unlegierter Stähle höherer Festigkeit)** K. L. ZEYEN. *Stahl und Eisen,* Vol. 56, June 4, 1936, pages 654-657. Tensile tests of butt and lap welds of 6 and 12 mm. thick sheets of 0.1 to 0.7% C steels indicated these could be welded with the proper electrodes. Various covered, alloyed, cored, and austenitic electrodes were studied. A 0.55% C steel electrode proved unsuitable because of cracking in the weld. In electric arc butt welds best results in tensile, bend, and impact tests were obtained with a 25% Cr-20% Ni austenitic electrode. Superior results with this electrode were obtained in repeated bend tests, particularly after gas welding. See *Metals and Alloys,* Vol. 7, May 1936, page MA 244L/3. SE (7b)

**Welding Oil Tight Bulkheads.** W. SIMPSON. *The Welder,* Vol. 8, Sept. 1936, pages 1075-1076. Bulkheads up to 10 tons are completely welded on the ground in covered shop of shipbuilding yard and then fitted into vessel. Step back method of welding is used to prevent distortion. Method of attaching stiffeners to bulkhead plating is shown. WB (7b)

**Gar Wood Gives Production "The Gun."** C. W. WOOD. *Industry and Welding, Third Quarter,* 1936, pages 82-85. Review of growth of welding and torch cutting in production of Gar Wood Industries. WB (7b)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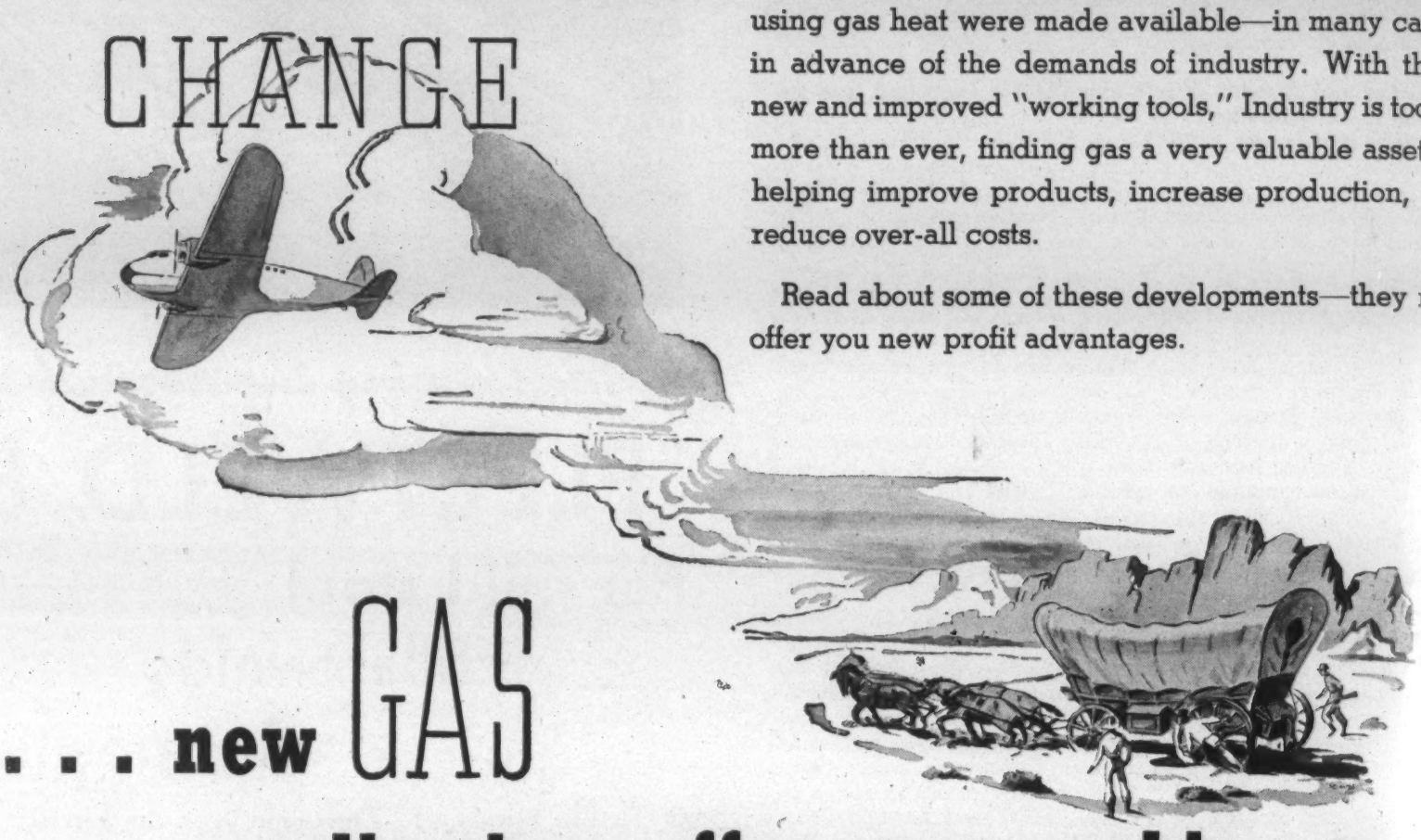

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# 8. FINISHING

H. S. RAWDON, SECTION EDITOR

Plating of Sheets (Das Plattieren von Blechen) L. MAYER. *Berg- und Hüttenmännisches Jahrbuch,* Vol. 84, Aug. 28, 1936, pages 82-88. Processes in use to coat a metal with another are (1) welding: rolling the metal onto the other at welding temperatures. (2) Compound casting. (3) Electrolytic deposition: for thin layers only. (4) Dipping and spraying. The methods are described, their fields of application discussed, and testing methods for the quality of the plating described; structural characteristics of the joints are shown in photographs. Ha (8)

## 8a. Pickling

Pickling Heat-resisting Cr-Ni Steels (Das Beizen wärmefester Chrom-Nickelstähle) RALPH J. SNELLING & E. T. RICHARDS. *Chemische Apparatur,* Vol. 23, Aug. 28, 1936, *Supplement "Werkstoffe & Korrosion,"* pages 58-59. Austenitic Cr-Ni steels are far more resistant to heat and chemicals than the ordinary Cr-Ni steels with 1-2% Cr or Ni. These are readily pickled with $H_2SO_4$ solutions of medium concentration, whereas scale from austenitic steels is completely removed only by stronger solutions containing $HNO_3$. Pickling solutions for austenitic steels containing 16-18% Cr and 8% Ni need no inhibitors. An addition of NaCl to $H_2SO_4$ solutions is not so beneficial as to add 2-3% of HCl and warm. Oxide impurities are removed from austenitic steels by solutions containing 30-40% HCl or 25% $HNO_3$, pickling temperature 50°-65° C. These solutions are often used one after the other with intermediate rinsing in hot water. Pickling vats are lined with ceramic material or better with Cr-Ni steels, 5-6 mm. thick. HR (8a)

The Theory of Inhibitors (Zur Theorie der Sparbeizzusätze) W. MACHU. *Berg- und Hüttenmännisches Jahrbuch,* Vol. 84, Aug. 28, 1936, pages 62-68. Most inhibitors are materials of capillary-active nature which, according to present views, reduce the attack of the pickling acid on the metal itself and permit only the scale layer to dissolve because of the specifically stronger adsorption of the inhibitor particles by the metallic Fe and the formation of a covering layer on the latter. This colloidal layer does not exert its inhibiting action by mechanically prohibiting the access of the acid to the metal surface, or by increasing the overvoltage of H discharge at the cathodic places of the metal surface, but by reducing the diffusion and migrating velocity of the ions on account of the smallness and proximity of the intermicellular capillary spaces so that it is difficult for new ions to enter the border layer. Dissolving of Fe is, therefore, restricted and suppressed only by the reduction of the diffusion velocity. The covering layer protects, however, as found for Cr, Al, Fe and Pb, only if the free surface, i.e., the part of the surface which is entirely bare, does not exceed $10^{-4}$ cm.²/cm.² surface. A formula for calculating this part is given. Ha (8a)

Investigations of Electrolytic Pickling of Iron and Steel (Untersuchungen zum elektrischen Beizen von Eisen und Stahl) ROBERT MÜLLER. *Berg- und Hüttenmännisches Jahrbuch,* Vol. 84, Oct. 27, 1936, pages 108-115. A metal can be pickled either chemically or electrochemically; the difference being that the electrochemical process permits a controlled action (quantitatively) of the free electric charges on the substances while chemical methods can be influenced only slightly. Tests show that, in order to make electrolytic pickling practicable, the most suitable electrolyte is ½-1 *N* with regard to $Fe^{++}$ and contains 0.5-0.8% acids. For particularly short pickling periods, concentrated $FeCl_2$ solution acidified with HCl is recommended to be used at an elevated temperature, but not higher than 30°-40° C. A current density of 0.5-1.0 amp./dm.² is the most economical but it may be increased to 10 amp./dm.² to accelerate the pickling process. Power consumption is not proportional to current density, but increases from 0.005 kw. hr. at 0.05 amp./dm.² to only 0.086 kw. hr at 40 amp./dm.² Particular advantages of the electric process are (a) danger of pickling brittleness is avoided, and (b) heating of the bath is unnecessary as it is replaced by the effect of the electric current, and (c) the process is much more easily supervised. Nonferrous materials can be electrolytically pickled to advantage. Ha (8a)

Tanks in Pickling (Bottiche in der Beize) *Die Beizerei (Supplement to Emailwaren-Industrie),* Vol. 1, Sept. 24, 1936, pages 9-10. Discussion of arrangement of pickling tanks and materials for their construction. RAW (8a)

## 8b. Cleaning including Sand Blasting

2 **Metal Cleaning. I.** F. E. P. GRIGGS. *Canadian Chemistry & Metallurgy,* Vol. 20, Aug. 1936, pages 258-260. II. Oct. 1936, pages 316, 318. Dirts are classed as (1) rust and tarnish, (2) grease and oil and (3) material adhering to grease. A good cleaner must have wetting and penetrating power, have enough colloids in the solution to maintain in suspension the dirt removed and be just sufficiently alkaline to maintain the emulsions. Alcohol sulphates are recent additions to the cleaners. Electrolytic cleaning and solvent degreasing are discussed. Acid pickling baths are 3 briefly reviewed with special emphasis on inhibitors, accelerators, etc. The theory of inhibitor action is briefly discussed and a method of evaluation indicated. WHB (8b)

**Sheet Cleaning Arrangement (Blechreinigungsanlage)** OTTO VOGEL. *Die Beizerie (Supplement to Emailwaren-Industrie),* Vol. 1, Aug. 27, 1936, pages 6-7. Arrangement for bushing, washing, rinsing and drying of plates is described. RAW (8b)

4 **Vapor Degreasing Performed with Gas Fuel.** C. E. MACMILLEN. *Industrial Gas,* Vol. 15, Oct. 1936, pages 17-19, 23, 25. Applications and equipment are described. Ha (8b)

**Buick Shotblasts Large Castings Automatically.** FRANK J. OLIVER. *Iron Age,* Vol. 138, Nov. 26, 1936, pages 41-43, 102. Describes the method and equipment used by Buick Motor Company for cleaning 300 lb. castings, by shotblasting. Pangborn 5 rotoblast machines are used. VSP (8b)

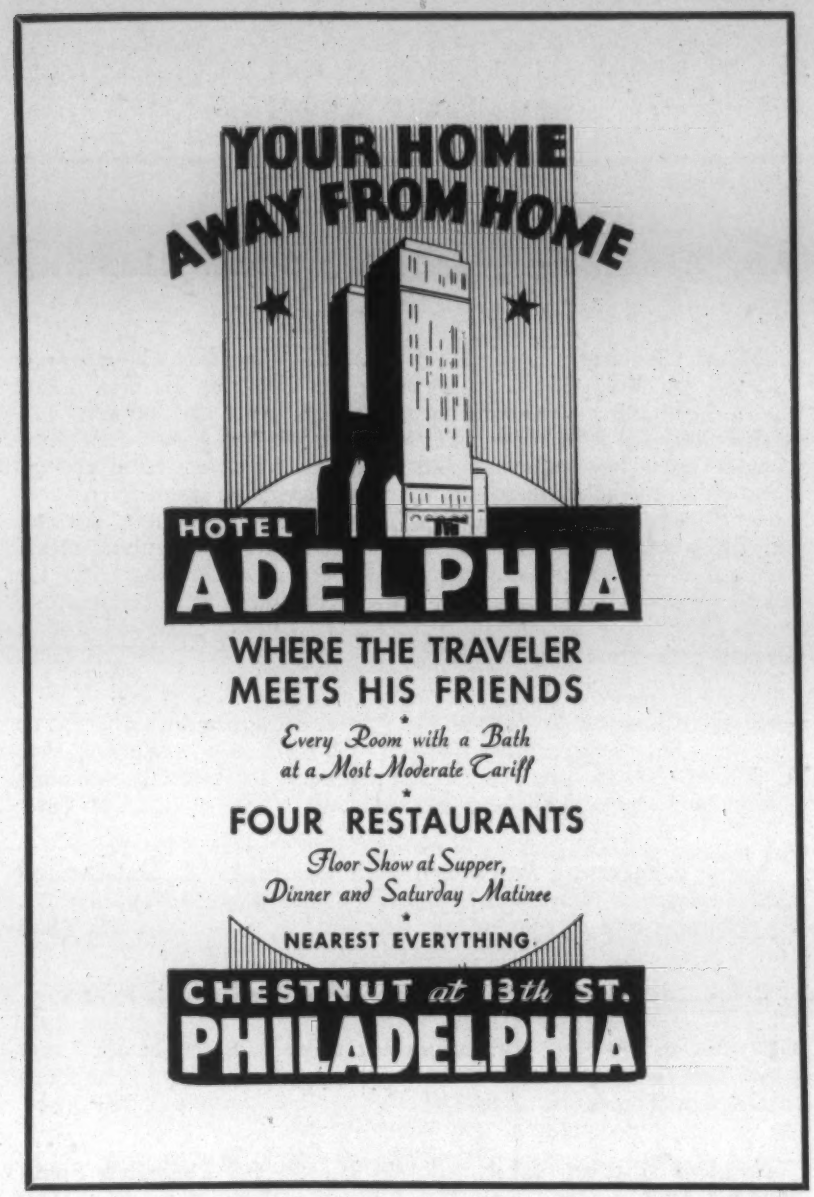
**Employs Specially Designed Gas Burner for Descaling Semi-finished Steel.** *Steel,* Vol. 99, Aug. 17, 1936, page 62. Heat from a burner held against surface of billet raises scale, which is blown off by compressed air. Burner is a hollow steel block casting about 10 in. long and 4½ in. wide. Gas-pipe welded to top of block serves both to supply fuel mixture and as a handle. 6 Block is cast with 16 holes in bottom, into each of which is screwed a steel alloy tip ¾ in. diam. Numerous small holes are drilled in each tip for burning gas. Premixed gas and air at 40 oz. pressure is used as fuel. MS (8b)

## 8c. Polishing & Grinding

7

**Thirty-five Years' Development in Buffing Compositions.** R. S. LEATHER. *Metal Cleaning & Finishing,* Vol. 7, Aug. 1935, pages 379-384. A buffing composition is a grease charged with abrasives in the correct proportions to give cutting action along with lubrication. The net result is a flowing or burnishing of the metallic surface. The commonly used abrasives are described. Tripoli is a high-silica material occurring in nature and has a 8 formation different from crystalline or amorphous silica. It is tough enough to cut a metal and also gives a smooth surface. Fe oxides are used less than formerly; rouge is used for buffing gold and silver and crocus for steel. Main constituent of emery is $Al_2O_3$ which is hard and does the cutting while the Fe oxide impurity does the polishing. Unfused $Al_2O_3$ is coming into wider use. It replaces silica and presents no silicosis hazard. Binders used are rosin, stearic acid, waxes, tallow, petrolatum. Lime compositions are discussed. A greasy lime will contain 26-28% 9 grease, a medium lime 23-25%, a dry lime 20-22%. If the grease is over 28% smutting of the work results. Best compositions solidify around 50-55 deg. C. Common buffing-wheel speeds are 7500-10,500 peripheral ft./min. A bibliography is given. GBH (8c)

**Surface Quality.** R. E. W. HARRISON. *American Machinist,* Vol. 80, Oct. 21, 1936, pages 878-879. The economical advan- 10 tages which can be obtained by high-grade surface finishing and greatest accuracy, and methods of achieving these are discussed. Determination of the roughness of the surface is briefly described, and the adoption of a standard method of determination is suggested. Ha (8c)




**A Study on Crushing of Nonplastics in Dry Pressing.** FRANK REA HENRY. *Journal American Ceramic Society,* Vol. 19, Sept. 1936, pages 235-239. Of interest to manufacturer and users of grinding wheels produced by mixing fine bonding material with abrasive grains and molded by pressure in semi-dry condition. Grain fracture is shown for $Al_2O_3$ and SiC. Forming pressure varies with grit-size combinations and shape of grains. Dense or open construction of abrasive wheel can be varied by choice of proper grain size and grain combinations. WB (8c)

## 8d. Electroplating

**Influence of Various Radicals on Chromium Hardness.** R. J. PIERSOL. *Metal Cleaning & Finishing,* Vol. 7, Aug. 1935, pages 385-387. In a 250 g./1 chromic acid solution the allowable sulphate variation cannot exceed .02 to .2 *N* (approx. taken from curve) as the cathode efficiency is 0 beyond these points. (Eff. is max. at 12% when sulphate is .05 *N.*) If NaF is used instead of a sulphate, however, allowable variation (of fluoride) is 0 to .6 *N.* Nitrate radical has no beneficial effect on hardness of chromium plate. A solution composed of $CrO_3$ 400, HF .66, HCl .34, $HNO_3$ 1.3 and $H_2SO_4$ 1.2 g./1 gave increased hardness at first but progressively poorer deposits were obtained and solution was not considered commercial. GBH (8d)

**Improved Method for Electrodepositing Alloys.** H. KERSTEN & WM. T. YOUNG. *Industrial & Engineering Chemistry,* Vol. 28, Oct. 1936, pages 1176-1177. In this improved method for electrodepositing alloys (U. S. Patent 1,924,439—1933) described for Ni-Fe alloys, the bath is kept saturated with respect to a salt of one of the metals—Ni formate—and the salt of the other—ferrous sulphate—is added continuously or at frequent intervals. An insoluble anode is used and the pH of the solution is kept constant by frequent additions of a neutralizing substance or by passing the electrolyte continuously over a solid neutralizing substance. The process satisfactory only when (a) one of the metals can be electrodeposited from a saturated solution, (b) the solutions do not react disadvantageously with each other chemically, and (c) a suitable neutralizing substance can be found. The method has also been applied to alloys of Co and Ni, Au and Ni. MEH (8d)

**The Use of Inhibitors (With Special Reference to Antimony) in the Selective Removal of Metallic Coatings and Rust.** S. G. CLARKE. *The Electrochemical Society Preprint* 69-18, pages 209-220. Presented April, 1936. The effect of $SbCl_3$ and Quinoline as inhibitors in a 1.16 sp. g. HCl solution at 20° C. is shown in a table:

| | Relative attack | | |
|---|---|---|---|
| | Acid alone | Acid plus $Sb_2O_3$ 2% | Acid plus Quinoline 1% |
| Mild Steel | 100 | 1.2 | 7.8 |
| Nickel | 100 | .4 | .9 |
| Cobalt | 100 | 16 | 19 |
| Tin | 100 | 1,905 | 17 |
| Cadmium | 100 | 419 | 43 |
| Zinc | 100 | 147 | 45 |
| Chromium | 100 | 400 | 718 |

$SbCl_3$ markedly restrains action of acid on steel, Ni and Co, but accelerates action on Sn, Cd. and Cr. Thus coatings of the latter metals on the former will be removed with little attack of the basis metal. The Sb is deposited as a loose film on the basis metal. Although the film is porous and cathodic it protects because of its high H overvoltage thus preventing acid from dissolving basis metal. Cu and brass are slightly more attacked by $HCl$-$SbCl_3$ solutions (.188 g./dm.$^2$ in 3.5 hrs.) than by straight 1.16 sp. g. HCl (.006 g./dm.$^2$ in 3.5 hrs.) but the loss is slight and Cu and brass can be considered as suitable base metals from which Cd, Zn, or Cr can be dissolved quantitatively. The $HCl$-$SbCl_3$ mixture can be used to strip hot dipped Sn or Zn coatings. The thickness of electrodeposited coatings cannot be determined accurately by the *rate* of solution in $HCl$-$SbCl_3$. A white matte Cd coating dissolved at the rate of .0001″ in 39 seconds. A "bright" Cd deposit (from a Turkey red oil-Ni sulphate brightener dissolved at the rate of .0001″ in 26 secs. The rate for an acid Zn deposit was .0001″ in 17 to 22 secs.; for a cyanide Zn deposit .0001″ in 9 to 12 secs. A good solution for quantitative removal of rust is given: Conc. HCl 100 parts, $Sb_2O_3$ 2 parts, $SnCl_2$ crystals 5 parts. The $SnCl_2$ reduces the $FeCl_3$ which is formed in the pickling to the ferrous salt. The latter will not etch the steel as much as the former. GBH (8d)

**Problems in Electrogalvanizing Round Wire.** ERNEST H. LYONS, JR. *Iron Age,* Vol. 138, Nov. 5, 1936, pages 47-49. After a brief historical discussion of electrogalvanizing of wire, some details of the commercial electrogalvanizing (Tainton) process used by the Bethlehem Steel Co. are given. Outstanding qualities of electrogalvanized wire are perfect adhesion, density, ductility and purity. Operation and maintenance of plant are simple and economical, and control of coating is accurate. VSP (8d)

**Modern Anodes for Nickel Baths (Neuartige Anoden für Nickelbäder)** O. REICHARDT. *Chemiker Zeitung,* Vol. 60, Jan. 29, 1936, pages 98-99. The two most important properties of anodes for electroplating are ready corrodibility and uniform structure. Cast anodes dissolve readily because of their porous structure and therefore greater surface, but their structure is often undesirably heterogeneous. On the other hand, rolled anodes seem to dissolve too slowly in low chloride baths. The development of lamellar anodes in Germany, and of "stream-lined" and bar anodes in America is discussed and their properties compared with other recently developed types, such as lattice anodes, "edge" anodes, of wavelike surface, etc. FPP (8d)

**Use of Cobalt-Nickel Solution to Produce Bright Electrodeposits.** LOUIS WEISBERG. *Steel,* Vol. 99, July 13, 1936, pages 43, 46. The small amount of Co in the solution is supplied during operation by special Ni-Co anodes. Mirror-like deposits are obtained by addition of brightening agents. Solution is used warm, current-density generally being 40-60 amp./ft.$^2$ It is amenable to chemical control at all times. Deposit is bluish white and has good ductility, adherence, and freedom from stress. Process is being used for plating directly on steel, brass, Cu, and cast-Fe. MS (8d)

**Electroplating with Silver.** A. R. POWELL & E. C. DAVIES. *Chemical Trade Journal & Chemical Engineer,* Vol. 99, Sept. 4, 1936, page 196. Abstract of British Patent 450,979 for direct production of bright, hard deposits. Colloidal solution of an alkali metal silicate or of a soap, including sulphonated soaps, is added to plating bath containing an organic sulphide and an excess of free alkali metal cyanide. MS (8d)

**Rhodium Plating (Oberflächenveredelung durch Rhodinierung)** *Chemische Apparatur,* Vol. 23, Aug. 25, 1936 *Supplement "Werkstoffe & Korrosion,"* pages 59-60. Canadian Ni-ores offer a new source for Rh. This metal, whose resistance to chemicals is better than that of Pt, is useful to protect silver-ware, medical instruments and metallic mirrors against tarnishing. HR (8d)

**Noble Metal Coatings (Edelmetallüberzüge)** V. SCHWENK. *Berg- und Hüttenmännisches Jahrbuch,* Vol. 84, Aug. 28, 1936, pages 88-95. Protection from corrosion by plating a base metal (mechanically or electrolytically) with a noble metal as Ag, Au, Pt, Pd, Rh, which alone have a present practical importance, is of purely mechanical nature, but not electrochemical, as for instance in galvanizing. The nobler metal is always put on a baser metal and the layer must therefore, be absolutely dense and cover the plated object completely. The various plating processes are reviewed briefly; electrolytic deposition is the most convenient method for rare metals and is treated at length for the above metals, Os, Ir and Ru not having found practical use yet. Plating solutions are given, and the combinations and compositions of noble metals which are rolled on base metals for use in jewelry are described in full. Ha (8d)

**New Cylinder Treatment.** *Engineer,* Vol. 162, Oct. 9, 1936, page 378. Describes new process for the treatment of internal combustion engine cylinders to reduce wear, developed by R. A. Lister and Co., Ltd., Dursley; known commercially as the "Listard" process. It consists in depositing chromium, by electro-chemical means, on cast Fe giving surface a great hardness. No details of process are given, but gives results of experiments on wearing quality of deposit. Process is based on Dutch invention developed in 1935. VSP (8d)

**Attention Called to Health Hazards in Industrial Electroplating Plants.** C. B. F. YOUNG. *Steel,* Vol. 99, July 6, 1936, pages 63-64, 66. Points out possible dangers connected with plating baths other than Cr and a few other recently developed processes, by describing case resulting in 1 death and affliction of 11. Adequate ventilation and scientific control of plating bath will correct such conditions. MS (8d)

**An Effect of Ultrasonic Radiation on Electrodeposits.** W. T. YOUNG & H. KERSTEN. *Journal of Chemical Physics,* Vol. 4, July 1936, pages 426-427. Ripples in electrodeposits of several metals and alloys resulting from the impingement of sound waves during deposition were investigated. The results, tabulated in terms of metal deposited, bath composition, current density, time, and character of deposit, indicate that stationary waves are set up in the solution and that the concentration of metal ions is relatively higher in layers separated by half wave-lengths. The best ripples were obtained from concentrated solutions of Fe or Zn salts, good ripples from black Ni solutions, and poor or no ripples in deposits of Co, Cd, Cr and brass. FPP (8d)

## 8e. Metallic Coatings other than Electroplating

**Origin of Porosity in Tin Coatings.** A. W. HOTHERSALL & J. C. PRYTHERCH. *Metal Progress,* Vol. 30, Sept. 1936, pages 55, 96. See *Metals & Alloys,* Vol. 7, Sept. 1936, page MA 455L/5. WLC (8e)

**Influence of Surface Cuprous Oxide Inclusions on the Porosity of Hot-tinned Coatings on Copper.** W. D. JONES. *Journal Institute of Metals,* Vol. 58, 1936, pages 193-198, plus 3 plates; discussion pages 205-210. See *Metals & Alloys,* Vol. 7, July 1936, page MA 357R/9. (8e)

**Progress in Rust Proofing.** HERBERT R. SIMONDS. *Iron Age,* Vol. 138, Oct. 15, 1936, pages 147-148, 150, 152; Oct. 22, pages 32-35. Discusses several processes avaailable for rust proofing metals, and gives some suggestions for guiding manufacturers. Considers galvanizing, phosphate coating, value of paint for rust proofing and also the cost of the equipment. VSP (8e)

**Sprayed Stainless Steel Resists Wear and Corrosion under Trying Conditions.** W. C. REID. *Welding Engineer,* Vol. 21, June 1936, pages 25-26. See *Metals and Alloys,* Vol. 7, Dec. 1936, page MA 594R/8. WB (8e)

**Copper in Metallization Processes by Wetting and Rubbing (Le Cuivre dans les Procédés de Métallisation au Trempé et au Frotté)** A. CHAPLET. *Cuivre et Laiton,* Vol. 9, Sept. 30, 1936, pages 421-424. The possibilities of producing metal coatings on other metals by dipping them in a solution of salts of the coating metal are discussed. In general, (a) salts of Cu produce a Cu layer on Fe and Zn, (b) solutions of Hg on Fe, Sb, Sn, Cu, (c) solutions of Au, Ag and Pt on Fe, Sb, Sn, Cu, Hg. The processes of Cu deposition in this manner are discussed exhaustively and solutions are given for covering Cu and brass with Sn, Ni, Ag and Au. The respective after-treatments are described in detail. 11 references. Ha (8e)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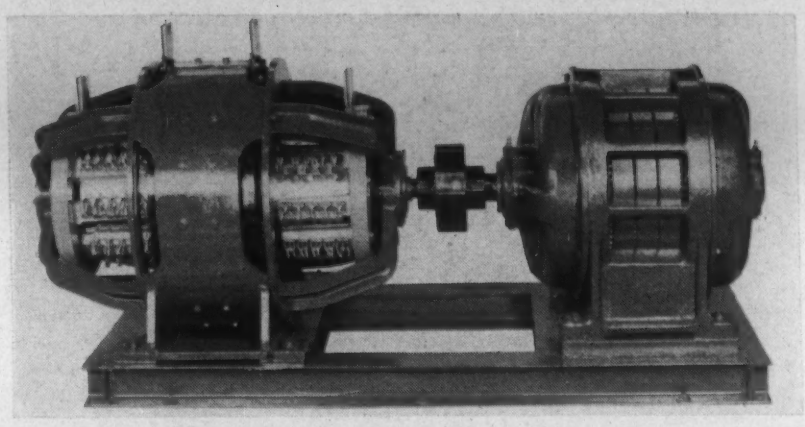

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**The Production of Metallic Films.** R. V. JONES. *Journal of Scientific Instruments,* Vol. 8, Sept. 1936, pages 282-287. Some electrical properties of thin metallic foil made by various methods are summarized, and the merits of each process considered. Briefly discusses methods of production which may be found in the references given. RAW (8e)

**The Development and Control of Spangles on Galvanized Iron.** W. G. IMHOFF. *Metal Cleaning & Finishing,* Vol. 7, Aug. 1935, pages 403-406. Discusses influence of draining, fluxing, and drying on spangle development. Articles should not be allowed to become dry on the draining rack. In the fluxing operation a concentrated solution is recommended (no specific data given). For drying, the ideal condition is said to be one which slowly dries out a considerable part of the water and leaves the surface protected with a crystalline salt glaze. Continuation of previous work. See *Metals and Alloys,* Vol. 7, Nov. 1936, page MA 538R/7. GBH (8e)

**The Metal Spraying Process by Schoop (Das Schoop'sche Metallspritzverfahren)** J. FRIEDLE. *Berg- und Hüttenmännisches Jahrbuch,* Vol. 84, Aug. 28, 1936, pages 68-77. The methods and equipment for spraying metal on metallic or other surfaces like glass, paper, celluloid, are explained and advantages over other metallizing processes discussed. Practical experience has shown the following to be the best diameters for the wire to be melted:

| Wire | Diameter | Melting Point |
|---|---|---|
| Sn | 1.7 mm. | 232° C. |
| Pb | 2.0 mm. | 327° C. |
| Zn | 1.5 mm. | 419° C. |
| Al | 1.2 mm. | 658° C. |
| Cu | 1.0 mm. | 1084° C. |
| Ni | 0.8 mm. | 1451° C. |
| Brass, bronze | 1.0 mm. | —— |

Ha (8e)

**The Sputtering of Large-Aperture Fabry-Perot Interferometer Mirrors.** S. TOLANSKY & E. LEE. *Journal of Scientific Instruments,* Vol. 8, Aug. 1936, pages 261-263. Large-aperture Fabry-Perot interferometer mirrors can be produced by sputtering Ag in argon. RAW (8e)

## 8f. Non-Metallic Coatings

**The Patina of Copper and Its Alloys (Les Patines du Cuivre et de ses Alliages)** A. CHAPLET. *Cuivre et Laiton,* Vol. 9, Sept. 15, 1936, pages 391-403. Artificial patina on Cu and its alloys ( bronze, brass) not only serves to produce a definite color or different colors on different parts of the same piece for decorative or artistic purposes but also exerts, like natural patina, a protective action as the thin surface layer limits the attack of the metal. Patinas consist, in general, of oxides (obtained by heating, and natural patinas), of carbonates (resulting from weather effects, artificial patina), of sulphides (black patina by sulphurous or hydrate of sulphur baths), of sulphates (patina formed naturally in air), of chlorides (formed under the action of sea water), and of simple elements (deposits of Sb, Pt. etc.). These different groups and the manner of their formation are discussed at length and the processes and solutions by which they are produced described in detail for Cu, bronze and brass. A very wide range of colors can be obtained by changing concentration and temperature of the baths. Cu can be covered with an artificial patina also by an electrolytic process (by Vernon), in which the piece is put as anode in a bath of 10 g. $MgSO_4$, 2g. Mg hydrate, 2g. KBr, 100 g. $H_2O$. Current density should be about 4 amp./dm.$^2$ for 15 min. with the bath heated to 95° C. The Cu is covered by this process with $CuSO_4$, $Cu(OH)_2$ which finally turns to $CuSO_4$, 3 $Cu(OH)_2$ which practically is the natural patina. The reason for obtaining different colors is discussed; surface tension seems to play an important part. Prescriptions for coloring brass and bronzes are added and directions given for the selection of a certain process for producing patina on various kinds of objects. 23 references. Ha (8f)

**Protection of Iron from Rust by Atramentation (Rostschutz des Eisens durch Atramentierung)** G. BÜTTNER. *Korrosion & Metallschutz,* Vol. 12, Aug. 1936, pages 208-211. "Atramentation" is a phosphate protection by which the Fe parts are bathed in a solution of 3.5 kg. primary concentrated Mg phosphate in 100 l. water which is heated to 98°-100° C.; the treatment lasts ½ to 1 hr. according to kind of Fe and quality of surface. The consumption of atramentol (the concentrated Mg phosphate solution) is about 120 g./m.$^2$ surface. The protective layer consists of many small crystals. Such phosphate layers will stand temperatures up to 300° C. but not mechanical stresses. Dipping in oil or paraffin gives protection against chemical influences, and the layer can also be colored with any paint. Ha (8f)

**Investigations of the Phosphate Protection of Ferrous Metals (Ricerche sulla Protezione fosfatica dei Metalli ferrosi)** O. MACCHIA. *Industria Meccanica,* Vol. 18, Aug. 1936, pages 492-495. The factors which influence the corrosion resistance of phosphate coatings are (1) the treatment to which the surface to be protected has been subjected, (2) concentration of the phosphate solution, (3) temperature of the treatment, (4) ratio of total phosphoric to free phosphoric acid. The various methods to produce phosphate coatings are discussed; the optimum protective value was found for a ratio 6.5-8.0 of total to free phosphoric acid. It is maintained that this ratio is of greater importance to the corrosion resistance than the other factors. 21 references. Ha (8f)

**Effect of Neutralizing Solutions on Ground Coat Draining.** G. H. MCINTYRE & P. E. GERDES. *Journal American Ceramic Society,* Vol. 19, Sept. 1936, pages 253-256. Neutralizer combinations (1) borax-soda ash, (2) caustic soda-soda ash-Na silicate, (3) soda ash-KCN, (4) soda ash-trisodium phosphate, and (5) commercial mixtures were studied with mobilometer and weight measurements on standard test plates. All neutralizers had good rust-inhibiting properties and affected enamel consistency in many cases, to increase or decrease the consistency. WB (8f)

**Frit Solubility. I. Comparison of Methods of Determination and Relation of Soluble Salts to Enamel Slip Consistency.** G. H. MCINTYRE & R. E. BEVIS. *Journal American Ceramic Society,* Vol. 19, Sept. 1936, pages 249-252. Relationship between soluble salts and enamel consistency determined by extraction methods and potentiometric titrations for cast Fe, sheet Fe and sheet steel enamels. WB (8f)

**Burning of Enamel on Castings in the Electric Resistance Furnace (Aufbrennen von Email auf Gussstücke in widerstandbeheizten elektrischen Oefen)** ERNST SCHMIDT. *Elektrowärme,* Vol. 6, Sept. 1936, pages 267-269. Enameling methods, fluxes and temperatures best applied are briefly discussed and a few furnaces described. Ha (8f)

# 9. TESTING

**Temperature Measurements with the Disappearing-filament Optical Pyrometer.** W. E. FORSYTHE. *Transactions American Institute Mining & Metallurgical Engineers, Iron & Steel Division,* Vol. 120, 1936, pages 171-188. Different forms of optical pyrometers are discussed and advantages and disadvantages of different types pointed out. The disappearing-filament type is best for most work. The necessity for using a monochromatic screen is stressed, and the meaning and use of the effective wave length of the screen is discussed. Methods of calibrating are described. An optical pyrometer can be calibrated just as definitely as any other temperature measuring instrument. Various corrections are indicated, including corrections for stray light, for absorption of windows and of smoke. The troublesome problem of measuring temperatures of bodies that do not radiate like a black body is discussed and the corrections for reducing such readings to true temperature are given for a number of different materials. JLG (9)

**Usefulness of Pyrometry in Smelting Works and Foundries.** EDMUND R. THEWS. *Metal Industry,* New York, Vol. 34, Nov. 1936, pages 421-425. The uses and limitations of heat measuring instruments in scrap melting and alloying industries are discussed. CBJ (9)

## 9a. Inspection & Defects, including X-Ray Inspection

C. S. BARRETT, SECTION EDITOR

**Manufacture of Crankshafts.** S. F. DOREY. *Heat Treating and Forging,* Vol. 22, Feb. 1936, pages 66-70; Mar, 1936, pages 123-127. From "Marine Machinery Defects—Their Causes and Prevention," read before the Institute of Marine Engineers, Dec. 10, 1935. Discusses methods of manufacture and heat treatment of large crank-shaft forgings, effect of stress concentrations, and causes and prevention of breakages in bolts and studs. Gives examples of failure. M[illegible] (9a)

**Microchemical Surface Examination (Mikrochemische Oberflächenprüfung)** M. NIESSNER. *Berg-und Hüttenmännisches Jahrbuch,* Vol. 84, Oct. 27, 1936, pages 105-108. Sensitive chemical methods for determining the heterogeneity of metallic surfaces, particularly the presence of corrosion-initiating non-metallic inclusions, are described. The metal is pressed into gelatin paper (air bubbles being carefully excluded) that has been treated with a specific reagent for the element sought and the distribution of the latter is quickly disclosed. Several practical examples of the use of the method are given. Ha (9a)

**Radium Inspection of Metal Structures.** ROBERT C. WOODS. *Iron Age,* Vol. 138, July 16, 1936, pages 49-52, 115, 116-117. Presents some of the principles which make Ra of commercial interest, and discusses some of its various industrial applications. From standpoints of cost and efficiency high intensity X-rays are superior where metal is not too heavy, but as material thickens, 4" or more, gamma rays are more efficient. VSP (9a)

**The Control of Composition in the Application of the Debye-Scherrer Method of X-ray Crystal Analysis to the Study of Alloys.** WILLIAM HUME-ROTHERY & PETER WILLIAM REYNOLDS. *Journal Institute of Metals,* Vol. 60, Oct. 1936, pages 541-550. (Advance Copy No. 751.) The application of X-ray diffraction to the study of alloys is discussed critically with special reference to errors due to uncertainty of the exact composition of filings used as the specimen. Where practicable it is desirable to analyze the actual filings from which the representative small sample used in preparation of the specimen has been screened. Methods are described for the preparation of perfectly clean filings suitable for accurate chemical analysis. In determination of phase boundaries from lattice spacings of 2-phase alloys misleading results may be obtained if the temperature of the preliminary anneal of the material in lump form is not suitably related to that of the final annealing of the filings. JLG (9a)

**The Automatic Grading of Tinplates.** *Mechanical World & Engineering Record,* Vol. 99, Mar. 13, 1936, pages 271-272. Combined time and gravity devices control a new machine which sorts tinplates according to their weight. The tolerance can be adjusted, and up to 20 sheets can be automatically handled per minute. Each cycle includes 19 operations. WH (9a)

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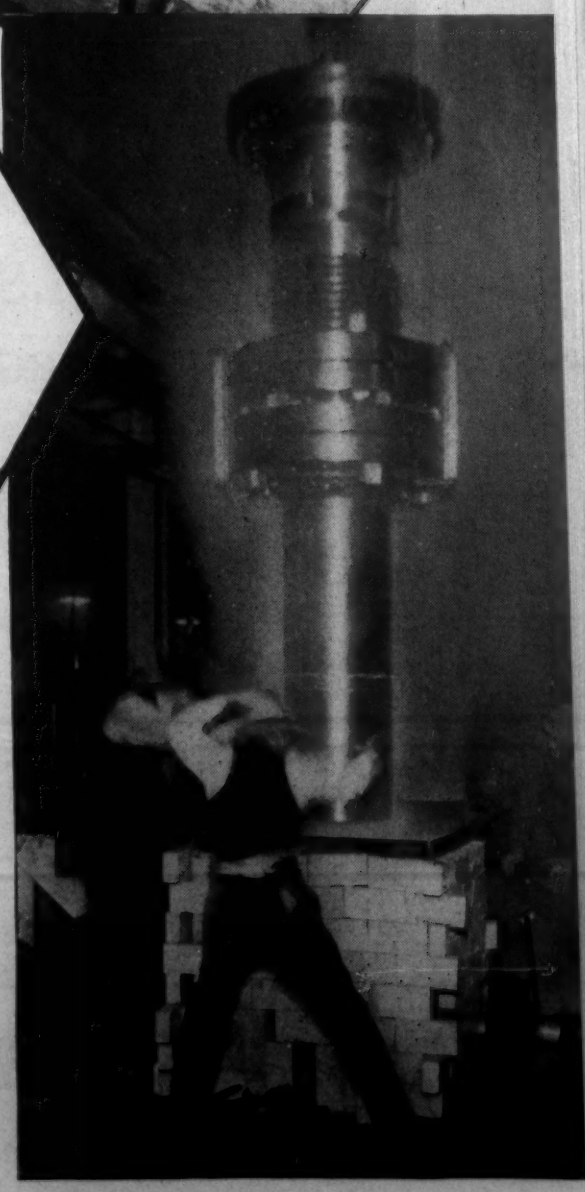

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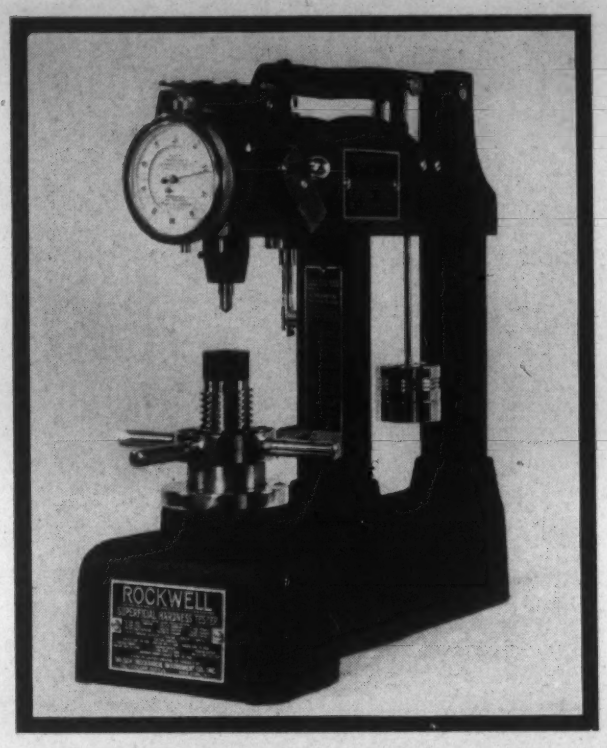


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6 **The Relation Between Radiographic Results and Tensile Strength of Cast and Forged Piston Alloys (Ueber den Zusammenhang zwischen Röntgenbefund und Festigkeit bei gegossenen und gepressten Kolben-Legierungen)** E. SCHIEDT. *Metallwirtschaft,* Vol. 15, Sept. 11, 1936, pages 857-862. Radiographs show irregular distribution of heavy metal additions, especially in Al alloys of high Cu content, but there is no decrease of tensile strength associated with these structures. Radiographs of eutectic and hypereutectic Al-Si alloys show casting porosity and pipes which are associated with low tensile strength. The mechanical properties of these alloys can be correlated with their microstructure and back reflection diffraction photograms. GD (9a)

7 **An X-ray Powder Camera.** M. J. BUERGER. *The American Mineralogist,* Vol. 21, Jan. 1936, pages 11-17. Describes a design which departs considerably from that of the usual powder camera and offers a number of conveniences. Details of construction, adjustment, preparation of samples, loading and film size uniformity are discussed. EF (9a)

## 8 9b. Physical & Mechanical Testing

W. A. TUCKER, SECTION EDITOR

**P. F. Characteristics of Steel.** B. F. SHEPHERD. *Iron Age,* Vol. 138, Oct. 22, 1936, pages 22-28. Considers methods in use for determination of grain size of steel and discusses the penetration fracture or P. F. test. Test consists of hardening specimens of definite section from a range of temperatures, fracturing by impact and examining visually for fracture grain size and hardenability. Fractures are classified by comparison with set standards numbered from 1 to 10. A number may be associated with a certain fracture grain size. Examination of an electric furnace heat and an open-hearth heat of tool steel gave quite uniform results as far as P. F. characteristics were concerned. Tabulated results of a test showed that location of test specimen and the amount of hot reduction had no effect upon the P. F. characteristic or inherent grain size of a 1.05% C tool steel. Includes table showing relation between A.S.T.M. and fracture grain sizes and a set of fracture samples at 5 diameters to permit grain size comparison visually. See *Metals and Alloys,* Vol. 7, Jan. 1936, page MA 25L/1. VSP (9b)


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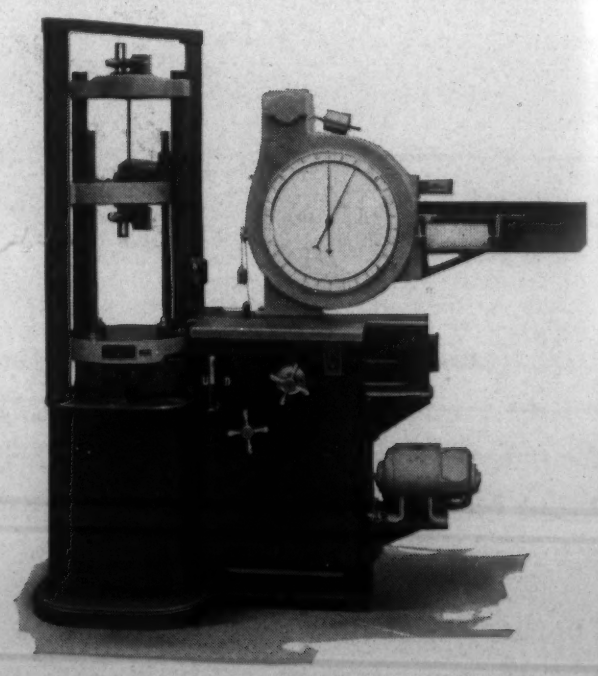

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## 9c. Fatigue Testing

H. F. MOORE, SECTION EDITOR

*The abstracts appearing under this heading are prepared in co-operation with the A.S.T.M. Research Committee on Fatigue of Metals. The purpose of this cooperation is to make readily available complete references to the literature on this subject. The Committee does not necessarily subscribe to the statements of either the author or the abstractor.*

**The Resistance of Some Special Bronzes to Fatigue and Corrosion-fatigue.** H. J. GOUGH & D. G. SOPWITH. *Journal Institute of Metals,* Vol. 60, Oct. 1936, pages 527-539. (Advance Copy No. 750). Fatigue and corrosion-fatigue tests on 4 types of special bronzes were carried out to determine the suitability of these materials for aircraft purposes. The materials tested were: P bronze (4.23% Sn and 0.13% P), Al bronze (8.89% Al and 1.40% Zn, Be bronze (2.25% Be) and Superston bronze (9.73% Al, 4.97% Ni, and 5.42% Fe). The corrosion-fatigue tests were carried out in a spray of 3% NaCl solution. Results show that the corrosion-fatigue resistance of the bronzes compare favorably with that of stainless steel, the Be bronze having the highest corrosion-fatigue resistance of any material so far investigated by the authors. The fatigue resistance of Superston is exceptionally high for a non-ferrous material, but the material seems to be highly susceptible to stress-concentration effects. JLG (9c)

**The Effect of the Addition of Lead on the Endurance Limit of a Certain Tin-Base Bearing Alloy.** JOHN N. KENYON. *Metal Industry,* New York, Vol. 34, Nov. 1936, pages 431-432. The addition of 4% Pb has little effect on the endurance properties of a Sn-base bearing alloy (Sn 80%, Sb 15%, Cu 5%). See *Metals and Alloys,* Vol. 7, Aug. 1936, page MA 412R/8. CBJ (9c)

**Addition of Lead to a Tin-Base Bearing Alloy.** JOHN N. KENYON. *Metal Industry,* London, Vol. 49, July 10, 1936, pages 33-34. 5 references. See *Metals & Alloys,* Vol. 7, Aug. 1936, page MA 412R/8. HBG (9c)

**A Study of the Fatigue Characteristics of Three Aluminium Specimens each containing from Four to Six Large Crystals.** H. J. GOUGH & G. FORREST. *Journal Institute of Metals,* Vol. 58, 1936, pages 97-112, plus 9 plates. See *Metals & Alloys,* Vol. 7, Aug. 1936, page MA 412R/1. (9c)

**Changes in Endurance and Damping as a Result of Hydraulic Pressure (Die Veränderung der Schwingungsfestigkeit und der Dämpfungsfähigkeit infolge hydraulischen Drückens)** A. LOHR. *Mitteilungen des Wöhler-Instituts,* No. 29, 1936, pages 1-55. Torsional fatigue specimens were subjected to pressure from all sides, in apparatus of the type developed by Bridgman, the pressure in some cases being raised as high as 12,400 atmospheres. Fatigue tests on Cu and Zn by a short-cut method of progressively raised stress, admitted to introduce strengthening by understressing, but presumably adequate for the purpose of comparison, showed no consistent effect from having been subjected to high hydraulic pressure. There was considerable scatter in both series. Damping tests likewise showed no perceptible effect from the pressure in the case of Zn, Cu, electron and duralumin. With Sn the elastic modulus was thought to have risen but fell again during the damping test. Pb showed a decrease in damping on specimens subjected to pressure, without change in modulus. HWG (9c)

## 9d. Magnetic Testing

L. REID, SECTION EDITOR

**Principles of Magnetic Testing (Principes des éssais magnétiques)** PIERRE BRICOUT. *Revue de Métallurgie,* Vol. 33, Oct. 1936, pages 638-640. General remarks. JDG (9d)

## 9e. Spectrography

L. W. STROCK, SECTION EDITOR

**Applied Electron Optics (Querschnitt und Umriss; Angewandte Elektronenoptik)** B. v. BORRIES & E. RUSKA. *Zeitschrift Verein deutscher Ingenieure,* Vol. 80, Aug. 15, 1936, pages 989-994. Principles, definitions and instruments for practical application in industrial processes, for spectrum examinations and structural determinations are explained. Ha (9e)


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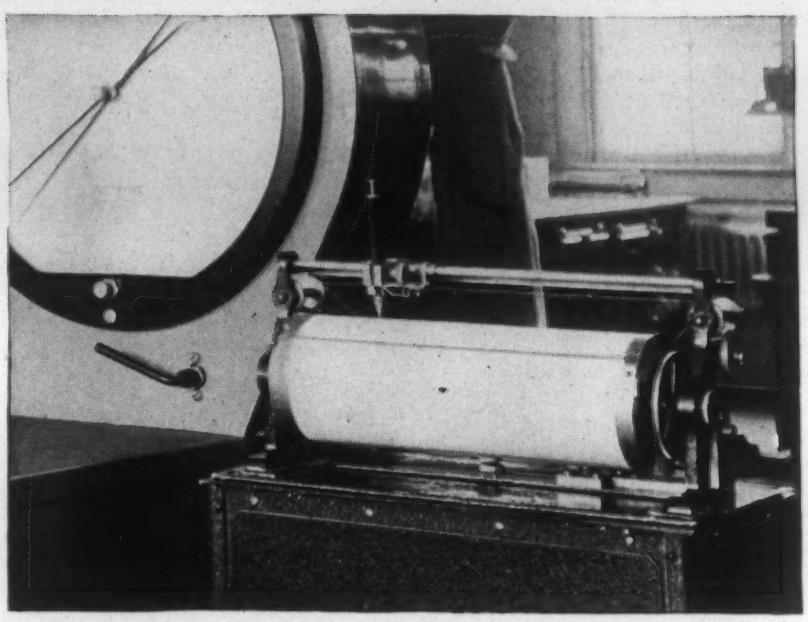

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# 10. METALLOGRAPHY

J. S. MARSH, SECTION EDITOR

**Black Fracture of Steel and the Nature of Graphite Inclusions.** N. T. GUDTSOV, F. D. BARANOV & O. O. KUZMINA. *Metallurg,* Vol. 11, May 1936, pages 3-18. In Russian. Black fracture sometimes observed on 1.2% C steel is associated with the presence of temper C, which precipitates on deformation at low temperatures. The color of the fracture is not a direct function of the amount of C precipitated. Five samples of 1.25% C, 0.3% Mn and 0.3% Si steels were investigated under a microscope, mechanically, dilatometrically, electromagnetically and by determination of specific gravity. Particular attention was paid to the appearance of fractures. The presence in fractures of graphitized steel of dark spots and bands can be associated with unequal straining of the component parts of the metal on cold deformation. Dilatometric measurements on repeated heating showed a continuous flattening of the solubility curve of temper C, lowering of the temperature of the end of solution and steadiness of the temperature at which structurally free temper C is formed. Graphitization can take place only when C content is at least 0.80%. Electric resistance decreases and magnetic induction increases parallel to the degree of graphitization, while specific gravity decreased with it. (10)

**Alloys of Magnesium. Part V.—The Constitution of the Magnesium-rich Alloys of Magnesium and Cerium.** J. L. HAUGHTON & T. H. SCHOFIELD. *Journal Institute of Metals,* Vol. 60, Nov. 1936, pages 605-612 (Advance Copy No. 756). Alloys of Mg and Ce were melted in a stainless steel crucible under a flux. They were investigated by thermal and microscopic methods. The eutectic was found to be at 21% Ce and 590° C. The solid solubility of Ce in Mg was found to be approximately 1.6% at the eutectic temperature and probably less than 0.15% at 337° C. There is a peritectic reaction at 614° C. Some of the alloys were feebly magnetic. JLG (10)

**Structure of Thin Metallic Films Deposited by Evaporation on Rocksalt (Die Struktur dünner auf Steinsalz aufgedampfter Metallschichten)** L. BRÜCK. *Annalen der Physik,* Series 5, Vol. 26, June 1936, pages 233-257. Each of the investigated metals Au, Ag, Al, Ni, Cu and Pd showed a characteristic temperature above which a thin layer could be obtained by evaporation. The layer consisted of a crystal formation of many small crystallites, all of the same orientation so that the diffraction picture of a monocrystal is obtained with electron rays. The actual conditions for various crystal types are described. 19 references. Ha (10)

**The Solid Solutions of Indium and Lead.** NICHOLAS AGEEW & VERA AGEEWA. *Journal Institute of Metals,* Vol. 59, May 1936, pages 235-242 (Advance Copy No. 735). Previous workers had concluded that In and Pb were soluble in all proportion. Alloys were studied by X-ray diffraction, thermally, and by measurement of electric properties. Results indicated that there is limited solid solubility and that there is a peritectic transformation. A corrected diagram is drawn. 10 references. JLG (10)

**Preferred Orientations in Hot-rolled Low-Carbon Steel.** M. GENSAMER & P. A. VUKMANIC. *Metals Technology,* Sept. 1936, *American Institute Mining & Metallurgical Engineers Technical Publication* No. 749, 5 pages. Mild steel rolled at 780° C. exhibits well-developed preferred orientations that closely resemble those developed on cold rolling. Steel rolled at 910° C. does not exhibit a well-defined texture, and such traces of texture as are observed may have been present prior to rolling at this temperature. JLG (10)

**Preferred Orientations Produced by Recrystallizing Cold-rolled Low-carbon Sheet Steel.** M. GENSAMER & B. LUSTMAN. *Metals Technology,* Sept. 1936, *American Institute Mining & Metallurgical Engineers Technical Publication* No. 748, 6 pages. X-ray data on annealed auto-body sheet were plotted as pole figures to obtain orientations. Cold-rolled mild steel exhibiting a well-defined orientation recrystallized with the formation of a particular orientation. At no temperature of recrystallization below the critical was there produced a random orientation of the crystallites. Glocker's relationship between deformation and recrystallization textures was again confirmed, but no rationalization of the process was offered. The pole figure for partly recrystallized steel originally exhibiting a normal texture agrees well with the pole figure for the surface of cold-rolled samples and lends support to the hypothesis that the surface texture may be partially recrystallization of the texture characteristic of the inside of the sheet. JLG (10)

**The Diffusion of Gases Through Metals. I.** C. J. SMITHELLS & C. E. RANSLEY. *Proceedings Royal Society,* Series A, Vol. 150, May 1, 1935, pages 172-197. The rate of diffusion of H through Cu, Ni, Fe, and Mo, and of N through Mo has been determined over a wide range of temperatures and pressures. The effect of temperature is satisfactorily represented by the exponential term in Richardson's equation. The effect of pressure is only approximately represented by the equation $D = K\sqrt{P}$, the deviation from this relation being most marked at low pressures. The effect of adsorption on diffusion is emphasized, and it is shown that activated adsorption is necessary for diffusion to take place. No diffusion of A or He could be detected with any metal and if it does occur, the rate is not more than $10^{-5}$ times the rate for the common gases. The rate of diffusion of H through a single crystal of Fe is the same as through ordinary fine-grained Fe. MAB (10)

**Austenite Transformation in Carbon and Some Alloy Steels at Low Temperatures.** S. S. STEINBERG & V. I. ZUZIN. *Metallurg,* Vol. 11, Aug. 1936, pages 3-15. In Russian. Magnetometric study showed that martensitic point is but the beginning of martensitic transformation which actually takes place within a range of several hundred degrees. This point depends mostly on concentration of C and other elements in γ Fe. As little as 0.1% C lowers it by 20° C., 0.1% Mn by 6° C., 0.1% Cr by 2.5° C. and 0.1% Ni by 1.5° C. Faster cooling raises the point, slower cooling lowers it. Slower cooling of austenite from temperatures above the critical, provided its speed remains above the critical cooling speed, increases the amount of undecomposed austenite and decreases the amount of martensite. Keeping austenite at temperatures around the martensitic point lowers the martensitic point for the remaining austenite. Stability of undercooled austenite increases with lowering temperature and increased C content. For an austenite with 0.95-1.24% C it drops sharply between 325° and 350° C. Decomposition products of austenite produced by isothermal decomposition within a range of 200°-300° C. have magnetic saturation 11-13% higher than annealed steel. Saturation of annealed steel is produced in quenched products after decomposition at 350°-400° C. In quenched steel the Curie point is very slight after drawing at 200°-300° C. and becomes equal to that of annealed steel after decomposition at 400° C. On heating quenched steels at a rate of 100° C. in 30 minutes the residual austenite begins to decompose about 200°-250° C. and the decomposition is practically completed at 300° C. The residual austenite is considerably less stable than the original. Magnetic saturation of drawn steel is greater than that of annealed steels. (10)

**The Elimination of Systematic Errors in Powder Photographs.** M. U. COHEN. *Zeitschrift für Kristallographie,* Vol. 94, July 1936, pages 288-298. In English. A general method has been developed to eliminate the effect of the most important systematic errors in precision powder photographs, those due to absorption, eccentricity, and film shrinkage when the photographs are taken so that the middle of the film is at the slit of the camera. It is independent of any standard substances or camera calibration marks, and it is applicable to various crystal classes without modification. The results depend only on the wave length used. When the camera construction is such that the ends of the film are near the slit, a shrinkage correction must be first made before the method is applicable. For this reason powder cameras should be constructed so that the primary X-ray beam enters, rather than leaves the camera through the middle of the film. WH (10)

**The Constitution of the Tin-rich Antimony-tin Alloys.** D. HANSON & W. T. PELL-WALPOLE. *Journal Institute of Metals,* Vol. 58, 1936, pages 299-310. Includes discussion. See *Metals and Alloys,* Vol. 7, Aug. 1936, page MA 416L/7. (10)

**Comparison of Two and Three Dimensional Contraction in Metallic Compounds (Vergleich von Volumen- und Abstandskontraktionen in metallischen Verbindungen)** F. LAVES. *Metallwirtschaft,* Vol. 15, July 3, 1936, pages 631-639. By the postulates of spatial-chemistry developed by Biltz and Weibke, the decrease in atomic volume for a given element in a group of metallic compounds is independent of the size of the second element and the crystal structure of the compound. A series of examples shows that these postuates are not generally true. These examples also show, contrary to the tenets of spatial chemistry, that many compounds of elements of the same nobility exhibit a contraction of the atomic radii of these elements, while compounds of elements of unequal nobility show an expansion of atomic radii. GD (10)

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**Precision Determination of the Lattice Constant of Pure Vanadium (Präzisionsmessung der Gitterkonstanten von reinem Vanadium)** M. C. NEUBURGER. *Zeitschrift für Kristallographie,* Vol. 90, Mar. 1936, pages 314-315. 100% pure V (free from H, O and N) was investigated and the lattice constant found to be $a = 3.0338 \pm 0.0003$ A.U. at 25° C. The density derived therefrom is $6.01_5$. The atomic radius of V is $r_A = 1.313_7$ A.U.
WH (10)

**The Theory of the Reflection of X-rays by Crystals (Sur la theorie de la réflexion des rayons X par les cristaux)** C. MANGUIN. *Journal de Physique et le Radium,* Vol. 7, June 1936, pages 233-42. Mathematical, theoretical treatment is presented.
FPP (10)

**Further Study of Copper-tin Alloys by X-ray Analysis.** E. A. OWEN & E. C. WILLIAMS. *Journal Institute of Metals,* Vol. 58, 1936, pages 283-297. See *Metals and Alloys,* Vol. 7, Oct. 1936, page MA 504R/6. (10)

**Non-metallic Inclusions in Ferroalloys.** B. MATUSCHKA. *Iron & Steel of Canada,* Vol. 19, Aug. 1936, pages 5-7. See *Metals and Alloys,* Vol. 6, Aug. 1935, page MA 332R/7. Ha (10)

**A Machine for Drawing Pole Figures Directly from X-Ray Diffraction Patterns.** DAN MCLACHLAN, JR. *Review of Scientific Instruments,* Vol. 7, Aug. 1936, pages 301-304. Pole figures conveniently represent preferred orientation of crystals, but their construction is difficult. This machine, developed in connection with work on preferred orientation in Fe-Ni rolled sheets, greatly speeds up the determination of pole figures. RWD (10)

**Diffusion in Solid Metals.** ROBERT F. MEHL. *Metals Technology,* Aug. 1936, *American Institute Mining & Metallurgical Engineers Technical Publication* No. 726, 46 pages. Bibliography of 302 references. This is the 15th annual lecture of the Institute of Metals Division, presented in New York Feb. 1936. The published work on the subject is critically reviewed. Metallurgical processes where diffusion plays an important part are discussed. It is concluded that much experimental work remains to be done on the subject of diffusion in solid metals, both for the purpose of determining diffusion coefficients and for explaining alloy behavior. JLG (10)

**Influence of Various Factors on Graphitization of Cast Iron during Solidification (Influence de divers facteurs sur la graphitisation à la solidification des fontes)** ALBERT PORTEVIN & ROBERT LEMOINE. *Journal du Four Electrique,* Vol. 45, May 1936, pages 167-168. See *Metals and Alloys,* Vol. 7, Oct. 1936, page MA 504R/9. JDG (10)

**A Further Study of the Constitution of the Cadmium-tin Alloys.** D. HANSON & W. T. PELL-WALPOLE. *Journal Institute of Metals,* Vol. 59, June 1936, pages 267-290 (Advance Copy No. 738). Sn-rich alloys were investigated by detailed thermal and microscopic analyses and by electric resistivity measurements. A peritectic reaction occurs at 223° C. with formation of a new phase ($\beta$), which undergoes eutectoid decomposition at 127° C. on cooling, producing the well-known transformation at this temperature. The eutectoid equilibrium temperature was found to be 133° C. Limits of the $\alpha$ and $\beta$ phases were accurately determined. The solidus lines and the solid-solubility line of Sn in Cd were determined and were in agreement with those found by Stockdale. See *Metals and Alloys,* Vol. 7, Aug. 1936, page MA416L/R.
JLG (10)

**Deep Etching as a Practical Testing Method for Iron and Steel (Djupbetning som praktisk undersöknings- och kontrollmetod för järn och stål)** B. D. ENLUND, HANS KJERRMAN & FR. VON HOMEYER. *Jernkontorets Annaler,* Vol. 120, June 1936, pages 259-293. Tests were carried out with $H_2SO_4$ (sp. gr. 1.10 at 15° C.). All tests were compared with a standard steel plate. Test pieces were cleaned in a bath of $H_2SO_4$ and $CrO_3$ and washed with water followed by alcohol. This method of cleaning was found to give the same results as mechanical polishing. Addition of 0.20% Cu to the steel reduces the etching to about 1/12 and Cu must therefore be closely watched if consistent results are to be obtained. S reduces the etching slightly while silica increases it. P increases the etching 7-fold. The outer portions of an ingot are more easily etched than the middle. Material of small grain is attacked more readily than that with large grains. Soft basic open hearth steel is more readily attacked than ordinary steel, and cold rolled more than annealed steel. A rough surface has a shorter induction period than a smooth surface and therefore shows more attack. Various examples of application to ingots, wrought Fe and tool steel are given with numerous photomicrographs. HCD (10)

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**Veining and Sub-boundary Structures in Metals.** L. NORTHCOTT. *Journal Institute of Metals,* Vol. 59, July 1936, pages 299-333 (Advance Copy No. 739). A network structure, termed veining, that occurs within crystals has been studied in several pure metals and in many alloys of Cu. Methods for its production are discussed. The structure is shown to be due to the precipitation from solid solution, in a network form, of the oxide of the metal during cooling. The influence of alloying additions on veining in Cu was examined and the effect of heat treatment and recrystallization on veining correlated with changes in hardness. Similar structures referred to as sub-boundary structures have been observed in a number of other alloys. These structures are also due to precipitation during cooling of a constituent of the alloy. 13 references. JLG (10)

**Origin and Growth of Graphite Nuclei in Solid and Liquid Iron Solutions.** H. A. SCHWARTZ & WOLFRAM RUFF. *Transactions American Institute of Mining & Metallurgical Engineers,* Vol. 120, *Iron & Steel Division,* 1936, pages 217-235. Includes discussion. See *Metals and Alloys,* Vol. 7, June 1936, page MA 311L/5. (10)

**Some Transient Phase Changes During the Graphitizing Reaction.** H. A. SCHWARTZ, H. H. JOHNSON & C. H. JUNGE. *Transactions American Society for Metals,* Vol. 24, Sept. 1936, pages 551-567. Paper read and discussed at the Chicago Convention of the Society, 1935. Reports a study of the changes in composition and specific volume of cementite and solid solution phases during graphitization. It is concluded that material partially graphitized at 925° C. (1700° F.) is converted on cooling and holding below $A_1$ into graphite and $Fe_3C$ + decomposed solid solution of approximately metastable eutectoid composition. At elevated temperature cementite decreases in C content and increases in density. The stable solid solution saturated at 925° C. (1700° F.) is less dense than the saturated metastable solution by about 1%. The Fe investigated contained 1.33% Cu and some of the discussion centered around possible effects of this element which effects are not discussed by the authors. 8 references. WLC (10)

**The Diffusion of Elements in Solid Iron.** GERARD E. CLAUSSEN. *Transactions American Society for Metals,* Vol. 24, Sept. 1936, pages 640-648. A table is compiled of diffusion rates of various elements in solid Fe. A microstructural study of the diffusion of P in medium C (0.30%) steel, high C (1.3%) steel and 50-50 Fe-Cu alloy is reported. The author points out that the table seems to indicate that elements farther removed from Group VIII of the Periodic Table diffuse faster than those nearer, and that the outer electron shell affects diffusion of an atom. In C steel P diffuses by driving C inward before it and in Fe-Cu alloys a similar effect upon Cu is noted. WLC (10)

**An X-Ray Study of the Transformations in Aluminum-silver Alloys (Röntgenographische Untersuchung der Umwandlungen in Aluminium- Silber-legierungen)** W. HOFMANN & K. E. VOLK. *Metallwirtschaft,* Vol. 15, July 24, 1936, pages 699-701. A high purity alloy of Ag with 25 atom % Al was studied with a high temperature X-ray camera, showing the $\beta$ phase to be body centered cubic with $a_o = 3.24$ A.U. at 700° C. This transformed to the hexagonal close packed $\gamma$ phase between 605° and 570°, which in turn formed $\beta'$ with a $\beta$-Mn lattice between 465° and 370°. The $\beta'$ lattice was stable down to room temperature. GD (10)

**Diffusion of Magnesium and Silicon into Aluminum.** HERTHA R. FRECHE. *Metals Technology,* June 1936, *American Institute Mining & Metallurgical Engineers Technical Publication* No. 714, 13 pages. Diffusion of Mg and Si from the Al-alloy core into the high-purity Al coating was studied under the following conditions: (1) Diffusion of Mg at 450° C. from an under-saturated alloy core. (2) Diffusion of Si at 510° C. from an alloy core containing excess Si. (3) Diffusion of Mg and Si at 510° C. from an alloy core containing an excess of $Mg_2Si$ and from an alloy core containing an excess of $Mg_2Si$ and Si. Concentration of diffused Mg and Si was determined by spectrographic analysis of successive layers machined in the coating. Rates of diffusion of Mg and Si corresponding to the first 2 cases above were found to be of about the same order of magnitude. However, if Mg and Si are both present in the alloy core in the ratio of $Mg_2Si$ they appear to diffuse in the approximate ratio of this compound. If the alloy core contains Si in excess of that required to unite all Mg as $Mg_2Si$ the amount of diffused Si will also be in excess. JLG (10)

**Austenite Grain Size Marked by Preferential Oxidation.** P. HERASYMENKO. *Metal Progress,* Vol. 30, Sept. 1936, pages 69-70. Method of determining inherent, austenite grain size by grinding a smooth surface on a specimen, heating to desired temperature and quenching. Period at temperature when the specimen is under oxidizing conditions should be not less than 15 min. to develop a decarburized and/or oxidized condition in the austenite grain boundaries. Micrographs show application of the test to 2 heats of SAE 3135 steel of different grain size treated at 1550°, 1750° and 1835° F. WLC (10)

**X-Ray Determination of the Thermal Expansion Coefficient of Beryllium and Tin (Röntgenographische Bestimmung des thermischen Ausdehnungskoeffizienten von Beryllium und Zinn)** G. F. KOSSOLAPOW & A. K. TRAPESNIKOW. *Zeitschrift für Kristallographie,* Vol. 94, Apr. 1936, pages 53-59. The following experimental results are reported: Be constants: $a = 2.2808$ A.U. (18° C.), $c = 3.5735$ A.U., $c/a = 1.5668$. Expansion coefficients:

| | 18° — 220° C. | 18° — 320° C. | 18° — 454° C. |
|---|---|---|---|
| $a_{11}$ | $1.04 \times 10^{-5}$ | $1.10 \times 10^{-5}$ | $1.31 \times 10^{-5}$ |
| $a_1$ | 1.50 | 1.54 | 1.57 |

Sn lattice constants and expansion coefficients in relation to temperature ranges:

| | | |
|---|---|---|
| 23° $a = 5.8188$ | $c = 3.1745$ | $c/a = 0.54554$ |
| 23° — 120° $a_1 = 4.64 \times 10^{-5}$ | $a_{11} = 2.24 \times 10^{-5}$ | |
| 23° — 150° $a_1 = 4.67 \times 10^{-5}$ | $a_{11} = 2.18 \times 10^{-5}$ | WH (10) |

**Notes on the Solidus Temperatures in the Systems Iron-Tungsten and Iron-Molybdenum.** W. P. SYKES. *Transactions American Society for Metals,* Vol. 24, Sept. 1936, pages 541-550. Melting temperatures of fine wire specimens have been used to locate more accurately the solidus lines in the Fe-rich portions of Fe-W and Fe-Mo systems. For the Fe-W diagram the solidus line reaches a minimum at 15% W and 1525° C. and rises to 1540° C. at about 32.5% W. The $\alpha$ solid solution line in the Fe-rich region runs from 32.5% W, 1540° C to 12% W, 1100° C. By determination of electrical resistance this line is found to lie between 6-7% W at 700° C. In the Fe-Mo system solidus falls to a minimum at 36% Mo, 1440° C. The boundary of the $\alpha$ field runs from a point 38% Mo, 1450° C. to about 18% Mo at 1200° C. and at 700° C. lies between 3-5% Mo. Microstructure of small block specimens indicate that in these systems the $\alpha$ phase is formed as a product of a peritectic reaction: Liquid + $\epsilon \rightleftarrows \alpha$. 5 references. WLC (10)

# 11. PROPERTIES OF METALS AND ALLOYS

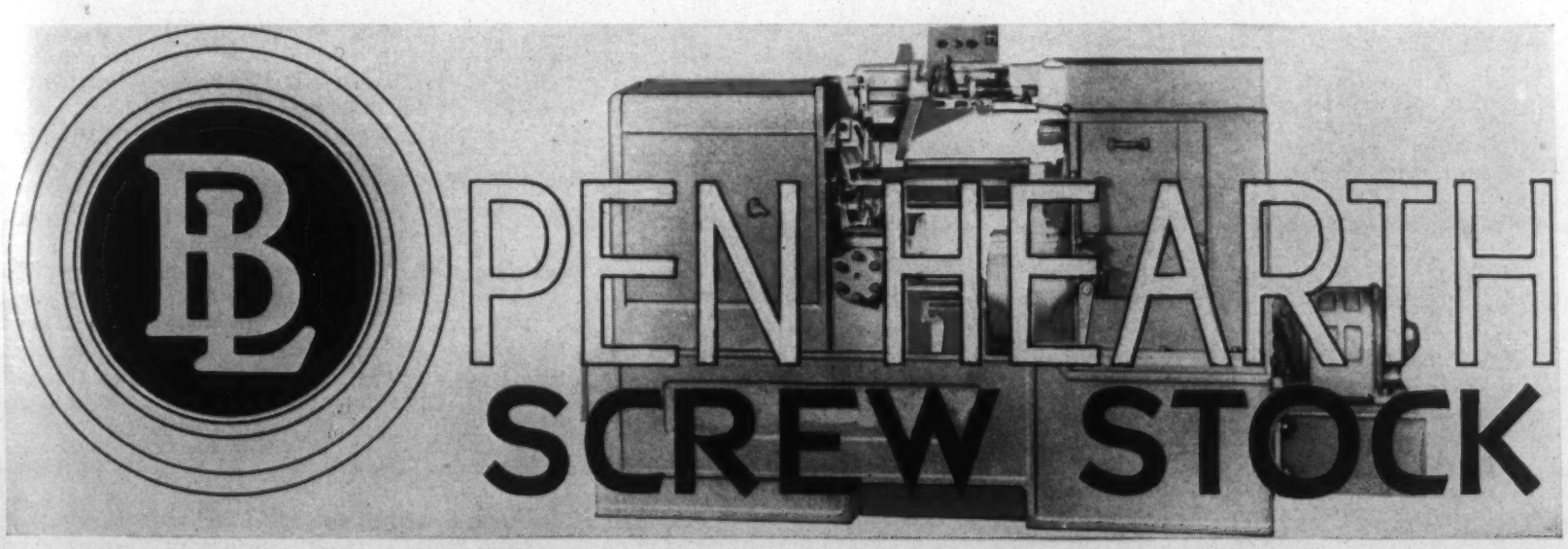
**Directional Properties in Rolled Brass Strip.** MAURICE COOK. *Journal Institute of Metals,* Vol. 60, Oct. 1936, pages 511-526. (Advance Copy No. 749.) Tensile properties of 64:36 and 70:30 brass were determined in directions parallel, normal, and at 45° to the direction of rolling after progressive reductions by cold rolling up to more than 90%. When the reduction by rolling was sufficient to produce directional properties the greatest strength and lowest ductility are obtained in the direction normal to rolling and the converse is true for the rolling direction. Both tensile and drawing tests showed that directional properties may remain in the annealed material. In annealed strip showing directional properties the tensile strength is least and the ductility greatest at 45° to the rolling direction, and it is in this position that ears are formed. The extent to which directionality exists in rolled and annealed strip is largely determined by the conditions of the penultimate and final annealings and the magnitude of reduction by rolling between these 2 anneals. A study of orientation of twinning planes in 70:30 brass strip showing appreciable directionality indicated that the frequency of orientation of the twinning planes is lowest at about 45° to the direction of rolling. The direction of maximum frequency of orientation of twinning planes appears to be fortuitous in strip not showing directionality in other respects. JLG (11)

**New Tantalum Carbide Tool Materials Feature Increased Strength.** PHILIP M. MCKENNA. *Iron Age,* Vol. 138, June 18, 1936, page 43. Ta carbide tool compositions, featuring an increase in strength and cutting qualities, have been made available within past few months. Results of research have now produced Ta carbide compositions for steel cutting having strengths comparable with high-speed steels, namely, as high as 403,000 lb./in.$^2$ at a hardness of 87 Rockwell "A," and possessing unique wear-resisting properties. VSP (11)

**Nickel and Corrosion-resisting Nickel Alloys.** ROBERT J. MCKAY. *Industrial & Engineering Chemistry,* Vol. 28, Dec. 1936, pages 1391-1397. Discussion, I. B. MCCORKLE, page 1397. Presented before the Division of Industrial & Engineering Chemistry of the American Chemical Society at the Pittsburgh Meeting, Sept. 1936. 34 references. Outlines the most useful developments in Ni alloys during the past few years. A general picture of the properties and corrosion resistance of commercially pure Ni is given, with references to detailed figures. These properties serve as a basis for the discussion of the newer alloys of Ni which makes up the body of the paper. The service properties of the Monel metals (including high-strength, hard-cast, and machine-quality Monels), the Cu-Ni and alloy welding rods, and Ni cast clad steel, Ni electroplate, Ni and alloy welding rods, and Ni cast Fe are outlined. The variation in physical properties and the abilities and limits of corrosion resistance of these alloys are compared. MEH (11)

**Recombination of Atomic Hydrogen in Adsorbed Layers (Die Rekombination des atomaren Wasserstoffs in adsorbierter Schicht)** O. I. LEYPUNSKY. *Acta Physicochimica USSR,* Vol. 5, No. 2, 1936, pages 271-298. In German. The adsorption and recombination of atomic H in an adsorbed layer on Ni, Fe, Cu, and Al surfaces was investigated over a temperature range of —180° to 0° C. EF (11)

**Chemical Methods of Producing Metal Powder for Industrial Use (Vorteile auf chemischen Wege gewonnener Metallpulver für die Werkstofferzeugung)** PAUL WEISSNER. *Chemiker Zeitung,* Vol. 60, July 1, 1936, page 536. A brief review of powdered-metal technique, emphasizing the growing use of powdered mixtures of metals and non-metals such as oil-graphite-bronzes and metal-ceramic combinations. FPP (11)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# 11a. Non-Ferrous

A. J. PHILLIPS, SECTION EDITOR

**Stress-strain Characteristics of Copper, Silver, and Gold.** J. McKeown & O. F. Hudson. *Journal Institute of Metals,* Vol. 60, Nov. 1936, pages 571-592. (Advance Copy No. 754.) The Ag and Au were of very high purity. One Cu was O free but with 0.003% Ag, and another contained 0.016% O but no Ag. Stress-strain curves were used to determine limit of proportionality, 0.01% proof stress, and Young's modulus. Materials were tested in the fully-softened condition, after slight tensile overstrain, and after heating the overstrained materials at different temperatures. Pure Cu and Ag when fully annealed showed no proportionality of stress to strain in any part of the diagram. Elastic properties induced by cold working were retained in large measure in all 3 metals after heating for short periods at moderately elevated temperatures when the amount of work had been small. Low-temperature annealing did not result in raising the limit of proportionality to the same extent as has been observed in other materials such as less-pure Cu. Young's modulus for O-free Cu was decreased by a 5% tensile overstrain to 15.7 x $10^6$ lb./in.$^2$ Larger amounts of overstrain appeared to cause a recovery in the value of the modulus. With 15% overstrain the value was 17.6 x $10^6$ lb./in.$^2$ Annealing Cu tended to restore value of modulus. Similar effects of reheating after overstrain were observed with Ag and Au, but the raising of the modulus was less marked than for Cu. Au, which had a value of 10.3 x $10^6$ lb./in.$^2$ when overstrained 5% gave 11.3 x $10^6$ lb./in.$^2$ when reheated 30 min. at 300° C. JLG (11a)

**Mechanical Properties of Aluminum-alloy Rivets.** W. C. Brueggeman. *Tech. Note,* No. 585, *Nat'l Advisory Comm. for Aeronautics,* Nov. 1936, mimeographed, 11 pages plus 28 Figs. Rivet strength, and shear and tensile strengths of joints were determined for rivets of 17ST, using a variety of heads. Cone-point heads showed advantages. Photos of the testing fixtures give a clear idea of the methods used. Detailed data are plotted for all tests. Work is to be continued on other Al alloys. HWG (11a)

**The Structure of Aluminium, Chromium and Copper Films Evaporated on Glass.** R. Beeching. *London, Edinburgh, and Dublin Philosophical Magazine & Journal of Science,* Vol. 22, Supplement Nov. 1936, pages 938-950. Methods of preparing and testing evaporated metal films for mirrors on glass are described. Such films consist mainly of the oxides of the metals but seldom in their normal crystal forms. The actual structures could not be fully determined, but Al seems to form $Al_2O_3$, and Cr behaves similarly. Thick films of Al and Cr were apparently pure metal on the surface. The chemical nature of the films is discussed. Ha (11a)

**Vacuum Lead Sheath as Applied to Power Cable.** R. W. Atkinson. *Wire and Wire Products,* Vol. 11, Dec. 1936, pages 695-704. Defects in Pb cable sheathing caused by present manufacturing methods are discussed, and a new process in which the Pb is protected from contact with the air and thus from the introduction of defect-producing impurities, is described. The molten Pb is cast from the melting kettle into an evacuated extrusion press chamber. The Pb sheath produced is homogeneous, free from inclusions, more flexible and more resistant to fatigue failure than is the ordinary Pb sheath. Ha (11a)

**On the Mechanical Properties of Tin-rich White Metals.** Toshio Nishihara & Hideo Nishimura. *Suiyokwai-Shi,* Vol. 9, Nov. 1936, pages 99-106. In Japanese. Two kinds of Sn-rich white metals with compositions of Sn 85%, Sb 8%, Pb 3%, Cu 5% and Sn 78%, Sb 13%, Pb 2%, Cu 6% were cast in chill molds. Their tensile and compressive properties and hardnesses at room and elevated temperatures were determined, and the first alloy is found to be superior. Abrasion tests with Amsler machine were carried out, and the second alloy showed somewhat better results, when properly cast and lubricated. HN (11a)

**Quantitative Interpretation of Gamma Rays Diffused by Lead Radiators (Interprétation Quantitative du Rayonnement Gamma Diffusé par des Radiateurs en Plomb)** E. Stahel, H. Ketelaar & P. Kipfer. *Journal de Physique et le Radium,* Vol. 7, Sept. 1936, pages 379-388. Physical explanation of the nature of "diffused gamma radiation." FPP (11a)

**Activity in Copper and Light Metals.** *Metal Progress* Vol. 30, Oct. 1936, pages 229-232. Advances in Al, Cu and Mg alloys are discussed. 7 references. WLC (11a)

**A Quaternary Aluminium—Silicon Alloy. Development and Properties of Cetal.** G. Welter. *Metal Industry,* London, Vol. 48, June 5, 1936, pages 627-634. The author lists as the most important alloys of Al in use today for casting purposes the Al-Zn alloy, known as the German alloy or 2L5, the Al-Cu alloy, so-called American alloy or 3L11, and the Al-Si alloy, so-called Silumin or Alpax. The compositions of these alloys, together with that of the recently developed alloy Cetal are given in table.

| | Composition in percent. | | | |
|---|---|---|---|---|
| Material | Cu | Zn | Si | Al |
| Cetal | 3 | 10 | 6.5 | Remainder |
| Silumin | .. | .. | 13.0 | Remainder |
| German Alloy | 2-3 | 10 | — | Remainder |
| American Alloy | 8 | — | — | Remainder |

He states that the Al-Zn and the Al-Cu alloys are used today for castings where high strength is not a major factor and the Al-Si alloys of the Silumin type are used where good casting properties are required although this material does not possess high mechanical properties of elastic and microplastic strength and has little resistance to repeated impact and fatigue bending. Cetal was developed by Czochralski & Welter. It shows better castability than the Al-Zn or the Al-Cu alloys and possesses better mechanical properties than the Al-Si alloy and can be produced at a low cost. Static and dynamic strength properties and physical properties of these different types of alloys are compared. The author claims that Cetal may be cast in a simple manner without the precautions which have been found necessary for some of these other alloys. The foundry practice used is briefly outlined. Cetal ingot may be made (1) of pure metals, (2) of pure scrap, or (3) of scrap of known impurities. Methods are suggested for production from scrap and the influence of Fe on the alloy is noted. The advantages claimed for this alloy are indicated. Data are presented in tabular form and graphically. HBG (11a)

**Critical Potentials of Secondary Emission (Potentiels Critiques d'émission Secondaire)** R. Warnecke. *Journal de Physique et le Radium,* Vol. 7, July 1936, pages 318-320. For several metals a certain correlation between values of critical potentials observed in the secondary emission curves and the corresponding values at the energy levels of the external orbits has been observed. The arrangement of the atoms rather than their constitution is believed to be the major clue to clarification of secondary emission phenomena. FPP (11a)

**Secondary Emission of Pure Metals (Émission secondaire de Metaux purs)** R. Warnecke. *Journal de Physique et le Radium,* Vol. 7, June 1936, pages 270-80. The secondary emission characteristic curves of several metals between 0 and 1500 volts are presented, and the principal factors that seem to govern the phenomenon are discussed. Al, Ni, Cu, Cb, Mo, Ag, Ta, W and Au were studied. Crystal structure and surface cleanliness are believed to be vital factors in secondary emission phenomena. FPP (11a)

**Positive and Negative Thermionic Emission from Molybdenum.** H. B. Wahlin & J. A. Reynolds. *Physical Review,* Vol. 48, Nov. 1935, pages 751-754. The positive and negative thermionic emission for Mo has been investigated. The electron work function has been found to be 4.17 volts and that of the positive ion 8.35 volts. The positive ion emission has been shown to agree with the Saha theory of ion formation to within the experimental limits of error. WAT (11a)

**A Thermodynamic Study of the Lead-Bismuth System.** H. S. Strickler & Harry Seltz. *Journal American Chemical Society,* Vol. 58, Nov., 1936, pages 2084-2093. Methods of calculation are presented whereby thermodynamic data can be used to establish accurately the condition of phase equilibrium in binary systems. The eutectic composition and temperature are fixed at 54.7 at. % Bi 125° C. The compositions of the two solid phases comprising the eutectic have been found to be 36.5 at. % Bi and practically pure Bi. The liquidus curve on the Bi side of the eutectic and the solidus on the Pb side up to 20% Bi have been calculated. The indicated existence of a peritectic at 184° C. on the Pb side of the system has been verified by thermal analysis. A revised phase diagram of the system is presented. MEH (11a)

**The Specific Resistance and Temperature Variation of Resistance of Nickel and Some of Its Alloys in the Annealed and Unannealed States.** I. H. Thomas & R. M. Davies. *London, Edinburgh and Dublin Philosophical Magazine and Journal of Science,* Vol. 22, Oct. 1936, pages 681-717. The relation between the specific resistance and its temperature coefficient, and the change in resistance occurring when a ferromagnetic substance becomes paramagnetic at the Curie point were studied and the theories involved discussed and explained by the test results. 7 references. Ha (11a)

**The Decomposition of Hydrogen-Sulphide and Water on Molybdenum Filaments.** F. E. T. KINGMAN. *Transactions of the Faraday Society,* Vol. 32, June 1936, pages 903-907. The decomposition of $H_2S$ at a pressure of 0.1 mm. on a Mo filiment was studied in the temperature range 400-685° C. $H_2$ and S are formed, the rate of reaction being proportioned to the pressure of $H_2S$. The energy of activation of the reaction is 25,000 cal. Water vapor at temperatures of 800-1200° C. forms Mo oxide and $H_2$, above 1,000° the H is atomic and is adsorbed by the Mo oxide film. The heat of activation of the decomposition reaction is 43,000 cal. PRK (11a)

**Properties of Monel at Low Temperatures.** D. E. ACKERMAN. *Metal Progress,* Vol. 30, Nov. 1936, pages 56-60. Tensile strength, proof stress, tensile modulus, torsional modulus, Brinell and fatigue life for a given load increase with decreasing temperature. Elongation, reduction and impact strength are unchanged with decreasing temperature for Monel Metal. Volume and dimensional changes are the only chaanges that take place except the loss of non-magnetic character and even this may be retained by appropriate alloy addition to a temperature of —117° F. Cold work is without effect on the magnetic properties of this alloy. WLC (11a)

**The Newer Bearing Materials and Their Lubrication.** H. C. MOUGEY. *Industrial & Engineering Chemistry, News Edition,* Vol. 14, Nov. 10, 1936, pages 425-428. This article briefly reviews the history of the wheel and of rotating bearings, and of Babbitt patents. It includes a table giving the most important types of bearings, their compositions, and the date of their invention.. The two theories explaining bearings are presented. The combination of properties which a bearing material must possess depends upon the forces that the bearing must resist in actual service. These properties are discussed under the following headings: Mechanical strength, bonding characteristics, m. p., fatigue resistance, anti-friction characteristics, non-scoring characteristics, conformability, embedability, corrosion resistance. Effect of temperature elevation on strength of Sn-base and Pb-base Babbitts is shown by curves. The problem of lubrication on the newer bearing materials, it is claimed, is now being satisfactorily handled through cooperation of the oil and automotive engineers. MEH (11a)

**Investigation of the Alloys of Platinum with Other Metals by Methods of Physico-Chemical Analysis.** V. A. NEMILOW. *Izvestia Sektora Fiziko-Khimicheskogo Analiza,* Vol. 9, 1936, pages 183-19. Review. NA (11a)

**Beryllium-Copper Alloys.** HORACE F. SILLIMAN. *Industrial & Engineering Chemistry,* Vol. 28, Dec. 1936, pages 1424-1428. 18 references. Reviews the story of the development of Be and its alloys with Cu. Gives the chemical and physical properties of the Be-Cu system, and the phase diagram. Discusses the resistance to fatigue, wear and corrosion, and outlines briefly the cold and hot-working, annealing, heat treating, pickling, welding by C-arc, soldering with soft and with Ag solders, and the uses of the Be-Cu alloys. MEH (11a)

**Boron Carbide (Borkarbid)** ADOLPH VOIGHT. *Oberflächentechnik,* Vol. 13, Nov. 3, 1936, pages 245-246. $B_4C$ is made from pure dehydrated boric acid and coke at 2500-2600° C. Compositions represented by $B_2C_2$ to $B_6C$ are not compounds but solutions of the elements in, or mixtures with $B_4C$. It is harder than SiC and almost as hard as diamond, and has greater impact strength than the hardest W carbides. Specific gravity is 2.6, m.p. 2350-2500° C., expansion coefficient $4.5 \times 10^{-6}$ cm./°C., (similar to SiC). Temp. coefficient of electrical resistance is negative. $B_4C$ is resistant to acids and alkalis even at high temperatures and resists oxidation at temperatures that would destroy diamond. When free of graphite or metallic B, $B_4C$ may replace diamond for grinding and polishing and for sand-blast nozzles. The price is still very high. Ha (11a)

**Bronzes in Machine Construction.** JOHN D. WATSON. *Metallurgia,* Vol. 14, Oct. 1936, pages 173-174. Discussion of composition, mechanical properties and corrosion resistance of various bronzes. JLG (11a)

**Properties of Metallic Solutions III. Surface Tension of Amalgams.** W. K. SSEMETCHENKO, B. P. BERING & N. L. POKROVSKY. *Acta Physicochimica USSR,* Vol. 5, No. 2, 1936, pages 181-192. In English. Measurements of the surface tension of some amalgams prepared from 17 different metals (Cs, Rb, K, Na, Li, Ba, Sr, Pb, Sn, Ag, Cu, Zn, Bi, Cr, Mg, Cd) and tested at 18-20° C. and at different concentrations are reported. The data obtained for active metals over the range of low concentrations satisfy the equation of Shishkovsky. At a certain critical concentration, deviations were observed. The course of the experimental curves are presented best by an equation obtained by integration of the complete equation of Gibbs. EF (11a)


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**Electrical Conductivity of Thin Metallic Layers, in Particular of Molybdenum Layers (Die elektrische Leitfähigkeit von dünnen Metall-, insbesondere von Molybdänschichten)** I. H. DE BOER & H. H. KRAAK. *Recueil des Travaux Chimiques des Pays-Bas,* Vol. 55, Oct. 15, 1936, pages 941-953. In German. The electrical conductivity of thin Mo-layers has been studied at various temperatures and in relation to thickness. The changes in relation to temperature are practically reversible at all temperatures lower than the highest temperature to which the metallic layer was exposed. If this temperature is exceeded conductivity increases in an irreversible fashion. If metallic films are considered as a transitional state between vapor and the metallic state, mutual locations of energy levels can be derived which permit an interpretation of the anomalous temperature coefficient of electrical conductivity. This energy scheme resembles Wilson's scheme for semi-conductors. EF (11a)

**The Adsorption of the Heavier Rare Gases by Mercury.** HANS M. CASSEL & KURT NEUGEBAUER. *Journal of Physical Chemistry,* Vol. 40, April 1936, pages 523-530. The surface tension of Hg in contact with Kr and Xe was measured at several temperatures and pressures. With the accuracy available (± 0.05 dyne/cm.) the influence of A could not be ascertained. The adsorbed quantities were calculated by means of the Gibbs equation and the heats of adsorption derived from these isotherms were compared with the thermal values according to the theory of dispersion of the Van der Waals forces. EF (11a)

**Formation of Cr Carbides (Sur la Formation des Carbures de Chrome)** ROGERS TESTUT. *Comptes Rendus,* Vol. 203, Nov. 16, 1936, pages 1007-1009. Cr carbide ($Cr_3C_2$) was prepared synthetically by heating the metal powder with C in a high frequency furnace above 1700° C. The excess C may be removed by heating the compound in $O_2$ at 900° C. The carbide is insoluble in hot conc. HCl and volatilizes slightly when heated above 1900° C. Another method of preparation is to heat Cr powder in an atmosphere of CO to get the following reaction:

$$19\ Cr + 6\ CO = 3\ Cr_3C_2 + 2\ Cr_2O_3.$$ FHC (11a)

**Aluminium and Aluminium-alloy Sheet.** WILLIAM ASHCROFT. *Metallurgia,* Vol. 15, Nov. 1936, pages 11-12. Describes commercially available sheets. JLG (11a)

# 11b. Ferrous

V. V. KENDALL, SECTION EDITOR

**Production and Properties of Steel from Carbonyl Iron (Ueber die Herstellung und die Eigenschaften von Carbonyleisen)** E. K. OFFERMANN. *Mitteilungen der Kohle- und Eisenforschung G.m.b.H.*, Dortmund, Vol. 1, June 1936, pages 85-120. By thermal disintegration of Fe carbonyl an Fe powder of great purity is obtained which can be formed into ingots or other shapes by remelting or sintering. Sintering is more advantageous as it requires less heat. It was investigated whether the sintering process can be used for normal steel production and particularly whether steel so produced is of such high grade that this production is desirable. The results of the very exhaustive experiments which are described in full, can briefly be stated as follows: the sintering method produces sound ingots when the sintering temperature is not lower than 1000° and does not exceed 1050°-1100° C. in order to avoid excessive N absorption. Pure Fe produced in this manner contained up to 0.03% C, up to 0.015% O and up to 0.022% N, and practically no P and S. Carbonyl steels up to 0.9% C could easily be made by sintering without, and up to 1.5% C with, carburizing agents. The strong tendency of carbonyl steels to form abnormal structures could be eliminated by slight addition of Mn; the amount of free C and of non-metallic inclusions increased, however, considerably with increasing Mn content. Carbonyl Fe could be alloyed quite easily with difficultly oxidable metals, e.g. Ni, and also with metals the oxides of which are easily reducible, e.g. Mn. Metals, such as Si, the oxides of which are difficultly reducible, could not be alloyed with carbonyl Fe. Carbonyl Fe and carbonyl steel showed only traces of P and S and contained neither Si nor Mn. In order to obtain a good structure in carbonyl steels with higher C contents, a slight Mn addition was necessary. A comparatively high N content was found in both carbonyl Fe and steel. Although carboyl Fe does not possess the same chemical purity as electrolytic Fe it may in many cases be substituted for the latter because of its great softness. Mn-free carbonyl steels showed the greatest purity, but that of the sintered Mn-containing carbonyl steel was low. The pearlite in Mn-free carbonyl steels has a strong tendency to pass over into the more stable, grainy state. The solubility in dilute HCl of the carbonyl steels sintered without Mn addition was lower, that of steels sintered with Mn considerably higher than the solubility of the steels made in the usual commercial manner. Mn-containing, remelted carbonyl steel had the same solubility in acids as the usual steels. Electric resistance and magnetic properties of pure carbonyl Fe were not better than those of ordinary steels. Carbonyl steels had a somewhat lower electric resistance. Carbonyl steels made by sintering and forging had a lower elastic limit and tensile strength than the ordinary comparison steels, because of very fine, microscopic pores and grainy formation of pearlite of the sintered carbonyl steel. Notch-impact toughness was very low due to segregation of cementite at the grain boundaries. Heat treatment improved this unfavorable condition. Endurance limit was the same as for ordinary, technical steels. Weldability was the best for pure carbonyl Fe, and for the carbonyl steels better than for ordinary steels. Hardenability and hardening penetration were less for sintered carbonyl steels than for ordinary steels, but the remelted carbonyl tool steel showed a good hardenability and penetration. Practically no differences were found with regard to wearing properties. The author concludes that, in general, carbonyl steels are not better than ordinary steels and respond less favorably to heat treatment. 25 references. Ha (11b)

**Present Estimation of Cast Iron (Die heutige Beurteilung des Gusseisens)** P. TOBIAS & K. CASPAR MANNHEIM. *Werkstatt und Betrieb*, Vol. 69, Sept. 1936, pages 225-227. The mechanical properties of cast Fe are definitely influenced by the sum of C + Si. Nevertheless the chemical composition is of little value for appraising cast Fe. The effect of internal stresses due to shrinkage can be diminished by development of high quality pearlitic cast Fe. Removal of internal stresses is accomplished by annealing at 500-600° C. followed by slow cooling. Pearlitic Fe is superior to bronze for bearings. HR (11b)

**Electric Conductivity of Welded Pure Aluminum (Elektrische Leitfähigkeitsmessungen an geschweisstem Reinaluminium)** P. BUSER. *Aluminium*, Vol. 18, Aug. 1936, pages 364-366. The theoretical loss in electrical conductivity of Al of 99.45% purity with an infinite number of sound welds was determined, on the basis of measurements on castings and rolled material, to be about 10%. Increase of electric resistance by welding can be prevented by using pure Al and keeping the ratio of F: Si in it = 2 : 1, and also by annealing at 300° C. and hammering of the welded seam in warm condition. Ha (11b)

**Titanium-Bearing Silico-Chromium-Tungsten Steel for Turbine Buckets.** P. B. MIKHAILOV-MIKHEEV. *Kachestvennaia Stal*, Vol. 4, No. 3, 1936, pages 34-44. In Russian. Investigation was directed towards determination of properties of steels differing from Krupps WF100 type by lower C and higher Ti content. 2 heats were investigated having a composition: 0.15 C, 1.75 Si, 0.77 Mn, 13.5 Cr, 12.64 Ni, 1.27 Ti, 1.59 W; 0.17 C, 1.55 Si, 0.77 Mn, 13.5 Cr, 13.08 Ni, 1.29 Ti, 2.08% W. Forging at 1100°-900° C. was possible but somewhat difficult, a tendency towards cracking being observed. Forgings produced were non-uniform in properties; hardness variations even after normalizing at 1000° C. were from 40-50 Brinell units. At this temperature the metal consists of austenite with carbide inclusions. The latter begin to transform into δ phase at 1100° C., and at 1300° C. about ¼ of the total area observed consists of it. Drawing after quenching at 1100° C. affects hardness but little, it varies from 170 in as quenched condition to 174 after a 20 minute draw at 800° C. reaching a maximum of 187 at 600° C. draw. After normalizing at 1100° C. both steels show about tensile strength 68 kg./mm.², 40-42% elongation, 55-60% reduction of area and 179 Brinell. Fatigue limit was found as 39 kg./mm.² for the first and as 44 kg./mm.² for the second heat. The latter figure is a rather high endurance ratio. Short time high temperature tests showed remarkable strength, yield point begins to drop appreciably only at 700° C. and tensile strength at 600° C. A 360 hour immersion in 10% solution of $HNO_3$, HCl, $H_2SO_4$ and $H_3PO_4$ did not affect polished specimens at all. A 720 hour immersion in sea water and alternating immersion in river water did not have any effect. A slight bright yellow tarnish was observed after 182 hours in saturated steam at 200° C. and a brown yellow tarnish after 224 hours in superheated steam at 400° C. Heated for 150 hours at 700° and 800° C. the steel had a grayish temper color, 60 hours at 900° C. produced a thin layer of gray scale impossible to remove from the surface. The same time of heating at 1000° C. covered specimens with a thin pulverulent coating of brown oxide. Mechanical tests indicated suitability of the steel for cold upsetting required for turbine manufacture. Machining is somewhat more difficult, requiring frequent regrinding of tools. (11b)

**Tantalum-iron Alloys and Tantalum Steels.** R. GENDERS & R. HARRISON. *Iron & Steel Institute*, Sept. 1936, Advance Copy No. 11, 37 pages. Alloys of Fe and Ta were investigated by thermal and microscopic methods. There are 2 eutectics formed by $Fe_2Ta$ with δ Fe and Ta at compositions of approximately 20 and 80% Ta respectively. Below a Ta content of 6.5% the δ solid solution decomposes on cooling into a eutectoid of γ Fe and $Fe_2Ta$. The solubility of Ta in γ Fe decreases with decreasing temperature to the γ → α transformation. The solubility of Ta in α Fe is small. Ta + Cb in amounts up to 20% was added to C steels of different C content and to Ni steels The effect of Ta is to decompose Fe carbide, and with excess of Ta the C steels consist essentially of Fe-Ta alloy with Ta carbide, a compound which is insoluble and inert to heat treatment. Ta-Fe alloys nitride readily in dissociated $NH_3$ at 500° C. and give deep penetration with increase in hardness. Extremely high hardness of the order obtainable in commercial nitriding steels is attained, together with deep penetration, by addition of Al to Ta steels. The reaction between Ta and $Fe_3C$ provides a means of producing steels containing included carbide particles by the use of a high-C base material, such as pig Fe. By melting Fe-Ta in contact with C, a product is obtained from which the carbide may be isolated by chemical means for use as an abrasive or sintered cutting material. 35 references. JLG (11b)

**Molybdenum High Speed Steel as a Substitute for Tungsten High Speed Steel.** H. BRIEFS. *Kachestvennaia Stal*, Vol. 4, No. 5, 1936, pages 14-19. In Russian. A comparison was made between cutting efficiencies of lathe tools made of 0.79% C, 3.78 Cr, 2.09 W, 1.10 V, 8.28 Mo; 0.75 C, 4.32 Cr, 2.26 W, 1.15 V, 7.90 Mo; 0.74 C, 4.39 Cr, 19.90 W, 1.20 V, 0.59 Mo both of German and American manufacture, but heat treated in Germany. W-Cr steels were superior. Using the same steels for twist drills it was found that Mo steels were inferior to W-Cr when drills were made in Germany, and were superior when U. S. product was used. (11b)

**Structure and Properties of 6% Chromium Steel and of Molybdenum Steel Containing 6% Chromium.** A. M. BORZDIKA & S. I. WOLFSON. *Kachestvennaia Stal*, Vol. 4, No. 4, 1936, pages 43-48. In Russian. Steels containing 5-6% Cr and 0.5-0.6% Mo together with low C have exceptional physical characteristics at temperatures up to 600° C. The same steels but without Mo are only slightly superior to common C steels. Quenching followed by a high draw increases properties of straight Cr steels of this type both at room and at elevated temperatures bringing them close to the properties of Cr-Mo steels. (11b)

# 12. EFFECT OF TEMPERATURE ON METALS AND ALLOYS

H. C. CROSS, SECTION EDITOR

*The abstracts in this section are prepared in co-operation with the Joint High Temperature Committee of the A.S.M.E. and the A.S.T.M. The purpose of this cooperation is to make readily available complete references to the literature of this subject. The Committee does not necessarily subscribe to the statements of either the author or the abstractor.*

**Heat-Resisting Cast Irons (Les Fontes Resistant aux Températures Elevées)** ANDRÉ DAWANS & LUCIEN DENOËL. *La Fonderie Belge,* Vol. 4, Mar.-Apr. 1935, pages 220-232. Work done under the supervision of Prof. H. Thyssen. Causes of growth of cast Fe are: (1) graphitization, (2) small internal cracks in the castings, (3) corrosion, (4) additive effects of above factors. To study corrosion at high temperature the following methods are available: (a) quantitative method: (1) weighing method (continuous or intermittent), (2) volumetric method, (3) electrical resistance measurement; (b) qualitative method: factors which influence results of tests are: (1) condition of atmosphere, (2) duration of test, (3) temperature, (4) condition of samples (shape, size and finish of the surface). Micrographical study of corrosion of cast Fe shows the following layers from inside to outside: (1) a central part consisting of graphite, ferrite and some remaining pearlite, (2) intermediate section in which the graphite is replaced by a clear brown coonstituent "a" (probably containing S compounds), and in which also appears a gray constituent called "b"; (3) an outer layer, the body of which is the "b" constituent containing some dark gray spots (probably resulting from oxidation of "a"), some black spots (holes or more important oxidation) and some white areas of ferrite. Conclusions of the study are: resistance to high temperatures is obtained by addition of Al, Si or Cr, the necessary content of each increasing, for a given temperature, proportionally to atomic weight. Ti and Mg additions show interesting effects on the structure of heat-resisting cast Fe. Useful bibliography is appended. See *Metals and Alloys,* Vol. 6, Feb. 1935, page MA 74L/1. **Note About the Study Entitled "Heat Resisting Cast Irons" (Note Relative au Bulletin sur "Les fontes Resistant aux Températures Elevées)** H. THYSSEN. *La Fonderie Belge,* Vol. 4, May-June 1935, pages 253-255. There is no critical temperature below which no graphitization takes place. The graphitization temperatures of cast Fe in relation to the C and Si contents for a heating rate of 250° C. per hour are given. A steel containing 1.6% C, 0.26% Si and 0.16% Mn can be graphitized by heating at a temperature lower than the $A_1$ point. Recently, Kinzel and Moore have shown the formation of graphite in low C steels. At temperatures lower than that of eutectoid formation the truly stable phase of the Fe-C system is graphite.

FR (12)

**Effect of Rate of Solidification and Magnesium Content on the Hardness of Silumin-Gamma (Einfluss der Erstarrungsgeschwindigkeit und des Magnesiumgehalts auf die Härte von Silumin-Gamma)** E. SCHEVER & E. SCHULZ. *Aluminium,* Vol. 18, Nov. 1936, pages 545-551. The relation between freezing velocity and hardenability by heat treatment of Al containing 12% Si, 0.3% Mn, 0.4% Fe and 0.3-0.5% Mg in sand and chill mold castings was investigated. Hardness increases with increasing solidification rate, depending on the amount and distribution of precipitated $Mg_2Si$ crystals. For 0.4% Mg alloys a hardness of 100 Brinell can be obtained:

in chill castings of 0.4" thickness after 1¼ hrs.
in sand castings of 0.4" thickness after 3½ hrs.
in sand castings of 2" thickness after 6 hrs.
in sand castings of 4" thickness after 12 hrs. of annealing at about 530° C.

Therefore, good silumin castings can be made with the uniformly high solidification rate obtained by low pouring temperature, cooling ribs, or by increasing the Mg content to max. 0.5%. Ha (12)


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# 13. CORROSION AND WEAR

V. V. KENDALL, SECTION EDITOR

**Two Unusual Installations of Cathodic Protection of Pipe Lines.** GEORGE I. RHODES. *American Petroleum Institute, Chicago,* Nov. 1936, 12 pages, *Oil & Gas Journal,* Vol. 35, Nov. 12, 1936, pages 139-144, 193. Whenever the cathodic protection of pipe lines requires a large amount of electric current, or the cost of electric current is high, it becomes necessary to minimize the amount of power required to keep the pipe lines suitably negative to the soil in which they are buried. The two installations described constitute: (a) that made in 1934 on the lines of the Interstate Natural Gas Co., Inc., in Louisiana between the Monroe Gas Field and Baton Rouge, La.; and (b) that made in 1935 and 1936 on the system owned by the Canadian River Gas Co. and the Colorado Interstate Gas Co. between the Amarillo Gas Field in the Texas Panhandle and Denver, Colo. Both installations differ from the ordinary installation of cathodic protection in that (a) the anodes or ground beds are fairly uniformly distributed or spread out along the pipe line instead of being concentrated at points in the general vicinity of the rectifiers or electric generators furnishing the current required for protection, and in (b) energy generated by the galvanic action between zinc and the pipe line itself by the use of zinc anodes uniformly spaced is utilized. In (b) Zn containing less than 0.01% of Pb and Cd is necessary as these impurities leave a coating on the zinc under galvanic action. If the line is a reasonably well-coated single line, then ordinary systems of protection are fully effective, and perhaps quite as cheap as the distributed anode system particularly where electric power is to be used. Wind-mill generators are equally applicable to the ordinary or concentrated ground-bed system, and to the distributed anode system. Zn is well adapted to the single coated line, and an installation is quite simple. With several lines on the same right-of-way, particularly with poorly-coated or bare pipe, then the distributed anode system is ideally adapted to service. It can be designed to fit any need, and the exact degree of protection required at any point can be secured and controlled or adjusted from time to time as necessary. Concentrated ground beds do not work well when high amperage is required, largely because of soil resistance causing large variation in protective voltage along the line. Zn in cathodic protection is new. Its application has been worked out in practice, but whether or not continued protection will be secured from the installations as made can be determined only by time. Thus far there has been no diminution in the galvanic activity of any of the Zn rods, but the protective currents and voltages are so much lower than are obtainable with power that some reinforcement may later be found necessary. However, the Zn installation can stand a much higher cost and still be cheaper than power and very much cheaper than reconditioning. Zn has one outstanding advantage in that it can be installed for as short a section as may be desired. It is necessary only to install an insulating joint in the pipe at each end of the protected section, or to use a number of extra anodes at each end to handle the currents flowing in from the unprotected sections of pipe. VVK (13)

**The Practical Problems of Corrosion. Part IX. Some Tests on Protective Painting. Final Report.** *Journal of the Society of Chemical Industry,* Vol. 55, Dec. 4, 1936, pages 337T-341T. An informative report on the protective value of paints in general. The data are derived from tests begun in 1930 throughout England. Conclusions are: (1) Effect of metallic bases.—In general, a steel which is more resistant to atmospheric corrosion when unpainted is more resistant when painted. (2) Effect of matter trapped between metal and paint coating.—Salt and condensed atmospheric moisture (even invisible films) are highly destructive to paint coatings. Fe rust is more damaging under $Pb_3O_4$ primers than under $Fe_2O_3$ primers. Mill scale ($Fe_3O_4$) on steel and wrought Fe shortens paint life considerably. Best method of removing $Fe_3O_4$ is by sandblasting. Painting should follow immediately. (3) Influence of paint on life.—A $Pb_3O_4$ primer under an $Fe_2O_3$ top-coat yielded best results. Metallic Zn powder in linseed oil confers some degree of electrochemical protection to steel at breaks in the coating. (4) Influence of atmosphere.—Products of coal combustion in city atmospheres are more detrimental to paint coatings than moist, pure salt air. AAA (13)

**The Scaling of Mild Steel in Sulphur-free and Sulphur-containing Furnace Atmospheres.** H. C. MILLETT & JOHN W. COBB. *Gas World,* Vol. 103, Nov. 2, 1935, pages 399-401. See *Metals & Alloys,* Vol. 7, Oct. 1936, page MA 508L/3. AHE (13)

**Inhibitors—Safe and Dangerous.** U. R. EVANS. *The Electrochemical Society Preprint* 69-1, pages 1-15. Presented April 1936. The electrolytic corrosion of a metal is considered from an examination of the reactions occurring at the anodic and the cathodic areas. The anodic reaction and the cathodic reaction will occur at the same rate but one of these reactions will control. Inhibitors may be of two classes depending on whether they inhibit the anodic reaction or the cathodic reaction. There are four modes of inhibition: (1) Anodic reaction controlling; Anodic inhibitor. (2) Anodic reaction controlling; Cathodic inhibitor. (3) Cathodic reaction controlling; Anodic inhibitor. (4) Cathodic reaction controlling; Cathodic inhibitor. An example of the first method is Na silicate as inhibitor in materials to be used in cleaning, or to be packed in Al. The corrosion is normally anodically controlled and the silicate smothers the anodic reaction. This method is considered safe. The second method is considered safe. The third method is dangerous because the anodic inhibitor may only partially reduce the anodic areas and thus concentrate the corrosive action into pits. If the anodic inhibitor completely covers the anodic areas, however, corrosion will cease. An example of the dangerous condition is a small amount of $Na_2CO_3$, silicate, or phosphate, in a chloride or sulphate solution acting on Fe. Even chromates produce intense localized attack in some cases when added in insufficient quantity. The remedy is to increase the amount of the inhibitor. The fourth method is essentially safe although some visible attack may occur. The classification of "safe" and "dangerous" classes may be extended to protection by oxide coats, paints, or metallic coats. A protective layer is dangerous if there is any chance that the corrosion at a gap in the coat will be more intense than that of the uncoated metal. GBH (13)

**Corrosion and its Relation to Grey-Iron Casting Production.** FRANK HUDSON. *Foundry Trade Journal,* Vol. 55, Aug. 13, 1936, pages 117-120. Paper presented on behalf of the Institute of British Foundrymen to the Polish Foundrymen's Association. Gray cast Fe is subject to certain types of corrosion attack, the examples of which are shown by the author. In the majority of cases this attack is not connected with production methods, and is essentially due to service conditions. The foundryman can help in some degree to combat the effect of corrosion by attention to casting finish, by keeping the surface skin unbroken, as far as possible, and ensuring the production of castings free from defects. Modification of the normal composition of gray cast Fe is not likely to have any great effect upon obtaining improved resistance, and at the present time the only positive way of minimizing attack is to employ one of the recognized corrosion-resisting alloy cast irons. The effect of the alloy additions has been to increase in thickness the graphite-free surface layer up to 0.004-0.005" and promote uniformity over the casting surface. Further investigation may possibly disclose that small alloy additions to the Fe have the property of stabilizing this surface layer to a marked degree, and it is well worth keeping this in mind as a possible future development in the production of a relatively cheap corrosion-resisting gray cast Fe. AIK (13)

**Corrosion in Stored Engines Prevented by New Slushing Compound.** *National Petroleum News,* Vol. 28, Jan. 1, 1936, pages 24-25. A new slushing compound, E.G.-174, developed by the Ethyl Gasoline Corp., is composed of triethanolamine 5-6%, aluminum stearate 10%, butanol 10-12% and lard oil the remainder. It is a clear, brown liquid of 550 seconds viscosity at 150° F., easily sprayed and forms a viscous jelly-like film. It is said to be especially effective for airplane engine parts and similar uses. VVK (13)

**Operating Observations at T. V. A. Fertilizer Plant.** HARRY A. CURTIS & ARTHUR M. MILLER. *Chemical and Metallurgical Engineering,* Vol. 43, Aug. 1936, pages 408-412. The corrosion problems in a phosphoric acid plant are briefly discussed. Cast iron is used for cooling tubes. Steel, Cu, brass, Duriron, bronze, graphite were also tested. Pb fails rapidly in contact with hot phosphoric acid but is satisfactory for handling cold concentrated acid. Duriron fails in scrubbers for waste gases but is fairly satisfactory for acid lines carrying warm concentrated phosphoric acid. Mo stainless steel is used for electrode wire. Ag and Ta were also tested. No refractory yet tried will withstand the attack of hot phosphorous pent-oxide unless the temperature is held down to prevent formation of metaphosphates. Pumps used for handling warm concentrated phosphoric acid are of cast Mo stainless steel with C less than .07%. A summary of production results is given. 2 references. PRK (13)

**Corrosion Protection in Refineries.** ARTHUR MARKS. *American Petroleum Institute,* Chicago, Nov. 1936, 21 pages. *Oil & Gas Journal,* Vol. 35, Nov. 12, 1936, pages 183-192. This paper, based upon a detailed analysis of records, reports, and papers received during the past eight years' activity of the Institute's Committee on Corrosion of Refinery Equipment, discusses the fundamental principles underlying the corrosion of refinery equipment and summarizes the application of protective measures to such equipment. It is intended to serve as a general guide to those concerned in the protection of refinery equipment against corrosion, and as a record of the protective measures utilized in the past, rather than as a discussion of current or new developments in the field of corrosion protection. The subject is considered under two general divisions, the first of which relates to so-called high-temperature corrosion and the methods used to protect equipment which is subject to such corrosion. The second part discusses the principles of low-temperature corrosion and protection against such corrosion. High-temperature corrosion agents and factors affecting high-temperature corrosion are discussed in relation to the chemical properties of metals and neutralizers and with conclusions based upon theoretical considerations and reported results of tests and usage. The controlling factors in low-temperature corrosion and protection are explained as an application of the electrolytic theory of corrosion. Summaries of tests and usage of protective methods are given. In concluding each division of the paper, the author, based upon his analysis of the Institute's records, offers recommendations for lines of investigation in the field of corrosion protection of refinery equipment. VVK (13)

**The Effect of Recesses and Cracks on the Corrosion of Iron (Der Einfluss von Spalten und Rissen bei der Korrosion des Eisens)** G. TAMMANN & H. WARRENTRUP. *Zeitschrift für anorganische und allgemeine Chemie,* Vol. 229, Oct. 27, 1936, pages 188-196. Numerous watch-glass tests are described for acid solutions of varying concentration and neutral salt solutions to test out U. R. Evans theory of anodic corrosion areas found where a deficiency of $O_2$ exists. Tests were first made with folded strip to form the recess but consistent results were not obtained. With the watch glass tests the diameter of the corrosion ring under the glass was investigated as a function of the acid concentration $2N$ to .0002 $N$ $H_2SO_4$ and $3N$ to .003 $N$ HCl. The ring increases in diameter with decreasing concentration and vanishes as the concentration increases to the above limits indicating that general corrosion over the entire surface under the watch glass takes place if the acid concentration is high enough and that $O_2$ concentrating cells exist where the acid concentration is lower. Tests of $H_2$ evolution made with cold rolled strip (80% reduction of electrolytic Fe) and strip in annealed condition shows lower corrosion rate in $H_2SO_4$ and $H_3PO_4$ for the annealed material with a constant ratio between the materials for the two acids. Tests made with neutral salt solutions give results similar to those with dilute acids and a true $O_2$ concentration cell is set up. WB (13)

**Corrosion of Metals—By Water and Carbon Dioxide under Pressure.** F. H. RHODES & JOHN M. CLARK, JR. *Industrial & Engineering Chemistry,* Vol. 28, Sept. 1936, pages 1078-1079. It has been found that the rate of corrosion of C steel by $H_2O$ and $CO_2$ increases rapidly as the pressure is raised to about 300 lbs./in.$^2$ Further increase in pressure of $CO_2$ to 450 lbs. has little effect on the rate of corrosion. Most nonferrous metals are corroded less rapidly than steel, and stainless steel is practically unattacked. These results were obtained with practically pure $CO_2$ and quiescent solutions. In any attempt to predict from the experimental data of this investigation the amount of corrosion under conditions other than those that existed here, one must consider the effects of agitation and presence of nitrogen. MEH (13)

**The Internal Corrosion of Natural Gas Transmission Pipe Lines.** M. T. BURTON. *Gas,* Aug. 1936, pages 46-50. Corrosion is due principally to $H_2S$ in water solution and also to $H_2SO_4$ formed from $H_2S$. Laboratory tests showed that natural gas containing $H_2S$ and O when saturated with $H_2O$ is very corrosive to steel. The products of corrosion may also be corrosive. Corrosion may be decreased by dehydration, removal of products of corrosion, O and $H_2S$, installation of oil sprays to coat the surface of the internal pipe wall. 18 references. HMW (13)

**Your Materials Handbook.** *Chemical and Metallurgical Engineering,* Vol. 43, Oct. 1936, pages 517-564. Information concerning the physical properties, composition, forms available, names, manufacturers, fields of application, and corrosion resistance of metals and alloys are given under the following headings: Al and alloys; Cu and alloys; Ni and alloys; Pb and alloys; noble metals and Ta, Ag and alloys; cast ingot wrought Fe; austenitic cast Fe; high Si-Fe; 4-10% Cr steels; low C stainless steels; high C stainless steels; 25-30% Cr-Fe; 18-8 Cr-Ni alloys; highly alloyed metals; low alloyed steels; abrasion resistant alloys; C; chemical stoneware; protective coatings; glass lined and fused silica; refractories; plastics; rubber and like products; wood. PRK (13)


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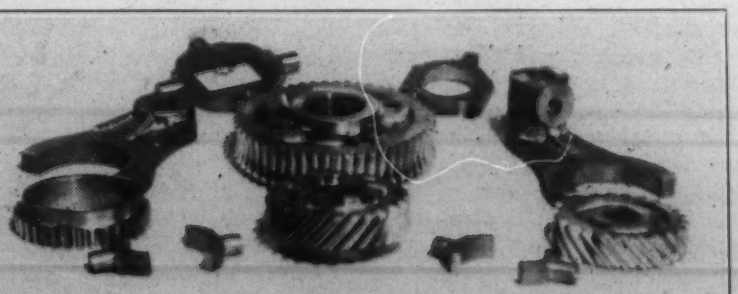

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**The Corrosion of Hot Water Heating Systems.** C. N. RIDLEY. *Steam Engineer,* Vol. 6, Oct. 1936, pages 12-13; Nov., pages 66-67, 71. A general discussion of causes of pitting. AHE (13)

**Tantalum Solves Severe Corrosion Problem.** HAROLD W. PAINE. *Chemical and Metallurgical Engineering,* Vol. 43, Sept. 1936, page 473. In the treatment of pyroxylin where one stage of the process required the use of strong salt brine containing mineral acid at 100° C., nascent Cl was present. To prevent corrosion satisfactorily, a brass pipe lined and sheathed with Ta was used for the steam inlet, the stirrer of stainless steel was sheathed with Ta and the valve plug was made of Ta. PRK (13)

**Theory of Galvanic Potentials. I.** P. GROSS & O. HALPERN. *Journal of Chemical Physics,* Vol. 3, Aug. 1935, pages 458-460. A thermodynamic study of the theory of galvanic potentials is presented. It is shown that, starting from strictly equilibrium conditions, the series of normal electrode potentials can be expressed through other partly known thermodynamic quantities, one group of which refers to the solid phase only, independent of the solvent used, while the other is characterized by the type of solvent. FPP (13)

**Steels with Low Copper Content and their Resistance to Corrosion (Les Aciers à faible Teneur en Cuivre et leur Résistance à la Corrosion)** U. GORDENNE. *Revue Universelle des Mines,* Vol. 12, Sept. 1936, pages 365-368. Tests were made with C steels of 55-65 kg./mm.$^2$ tensile strength and 17% elongation and Cu contents varying from 0.008% to 2.44% to determine their resistance to 30% $H_2SO_4$, 0.5% HCl and 0.3% citric acid. The results, expressed in loss of material in mg./cm.$^2$ surface, are shown in curves. These curves run almost parallel and have a hyperbolic shape. A content of 0.4% Cu seems to be the best for all attacking agents of which citric acid attacks least, then HCl, and $H_2SO_4$ most of all. Ha (13)

**On the Behavior of Pb in Distilled Water (Ueber das Verhalten von Blei in destilliertem Wasser)** O. BAUER & G. SCHIKORR. *Mitteilungen der Deutschen Material-Prüfungsanstalten,* Bulletin 28, 1936, pages 67-70. Former investigations had shown that the content of $CO_2$ in the water affected the rate of corrosion. Further investigations indicate that in the presence of wet air a protective film is formed on the Pb, by which the attack of $CO_2$ containing water is diminished as long as this film is not mechanically damaged. A content of Sb in the Pb accelerates the formation of the protective film. HR (13)

**Light on this Liner Wear Bogy.** *Gas & Oil Power,* Vol. 31, Aug. 1936, pages 192-194. Results obtained with a Diesel generating plant of the Allen type in London showed the liner wear of this installation to be about 1/3 that of usual medium-speed Diesel engine. The low wear is believed to be due to maintenance of moderately warm temperatures when idle, so that starting-up-wear, and liner and piston distortion are reduced. All lubricating oil is passed through a very fine filter. FPP (13)

**Solubility of Copper in Water as Regards the Application of this Metal in Pipe Line Construction, and Effect on Taste of Water (Beiträge zur Wasserlöslichkeit des Kupfers im Hinblick auf die Verwendung dieses Metalles im Wasserleitungsbau—Einfluss auf den Geschmack)** VICTOR FROBOESE. *Chemische Apparatur,* Vol. 23, July 25, 1936, Supplement: *"Werkstoffe u. Korrosion,"* page 49 (Abstracted from *Gas-u. Wasserfach,* 1934, page 225.) See *Metals and Alloys,* Vol. 5, Aug. 1934, page MA422. HR (13)

**Organic Inhibitors of Corrosion—Aromatic Amines.** CHARLES A. MANN, BYRON E. LAUER, & CLIFFORD T. HULTIN. *Industrial & Engineering Chemistry,* Vol. 28, Sept. 1936, pages 1048-1051. The aromatic amines form salts with corroding acids that ionize to give positive inhibitor ions, which form a protective coating by being adsorbed by the cathodic areas of the metal surface. The greater the cross-sectional area of the inhibitor ion taken parallel to the metal surface, the better the inhibiting value. Any radical, combination of radicals, group, or structure of a compound which causes the ring or rings of these aromatic amines to be inclined from the perpendicular to the metal surface which seems to be normal to anilines, will be responsible for greater cross-sectional area and will result in increased inhibiting value. Symmetrical dimethyl-anilines are less effective corrosion inhibitors than the unbalanced ones. Dimethylaniline, in which the two methyl groups are attached to the N, is the best of the symmetrical dialkyl-substituted anilines. Configuration of the inhibitor ion determines the closeness of the packing of the ions in the covering layer and the character of the film as to its penetrability to H ions. Less porosity of the film means greater inhibiting value. See *Metals and Alloys,* Vol. 7, Oct. 1936, page MA 508L/6. MEH (13)

**Influence of Purity of Aluminum on Corrosion by Hydrochloric Acid of Varying Concentration (Ueber den Einfluss der Reinheit des Aluminiums auf die Korrosion in Salzsäure verschiedener Konzentration)** W. J. MÜLLER & B. LÖW. *Aluminium,* Vol. 18, Oct. 1936, pages 478-486; Nov. 1936, pages 541-544. The rate of corrosion of Al of varying purity by HCl of varying concentration is studied. The purest Al (99.998%) was noticeably attacked only in 4 *N* HCl. The rate of corrosion curves of Al with 0.5% and with 5.0% impurities are similar to those found by other investigators. In all cases, 3 periods were observed: The incubation period (no solution), the induction period (reaction velocity increasing rapidly) and the reaction period (reaction velocity is constant or decreasing slowly). The incubation and induction periods become shorter with rising acid concentration. These phenomena and changes in temp. coeff. in the 3 periods are explained by the local element theory of Müller, according to which a protective layer is formed, the electric resistance of which decreases with decreasing purity, thus permitting access of the acid to the surface pores. Ha (13)

**Corrosion of Metals II. Lead and Lead-Alloy Cable Sheathing.** R. M. BURNS. *Bell System Technical Journal,* Vol. 15, Oct. 1936, pages 603-625. The corrosion of cable sheathing in aerial and underground installations is discussed. Aerial cables deteriorate because of corrosion fatigue resulting from repeated stressing rather than chemical corrosion. This trouble has been overcome to a great extent by use of Pb alloys having high corrosion fatigue resistance. Cable sheathing buried bare in the ground corrodes due to differential aeration cell action which seems to be independent of alloy composition. Cable sheathing in conduits corrodes by a chemical displacement mechanism which is governed by the presence of impurities, contact with nobler metals, and the chemical nature of the environment. The operation of the corrosion cell is promoted by $O_2$, nitrates, alkalies, organic acids, and chlorides (at low concentrations) while protective action is afforded by silicates, sulphates, carbonates, colloids, and certain organic compounds. Corrosion by stray currents is a common and very destructive type of corrosion and must be combatted by proper installation, inspection, and maintenance. See *Metals and Alloys,* Vol. 7, Oct. 1936, page MA 509R/3. HFK (13)

**Disperse Systems in Gases; Dust, Smoke and Fog.** *Transactions of the Faraday Society,* Vol. 32, Aug. 1936, pages 1041-1297. Papers presented before the Faraday Society in April, 1936, in a general discussion of disperse systems in gases are given. Much information having both a direct and indirect aspect on the subject of atmospheric corrosion is given. Titles of the papers are:

Introductory Paper: **Disperse Systems in Gases.** R. WHYTLAW-GRAY, page 1042; **On the Properties of Aerocolloid Systems, with Regard to their Dependence on the Methods of Formation.** KARL ERNST STUMPF & GERHART JANDER, page 1048, Discussion, page 1054; **A Sedimentation Method of Finding the Number of Particles in Smokes.** R. WHYTLAW-GRAY, W. CAWOOD & H. S. PATTERSON, page 1055, Discussion page 1059; **The Influence of Pressure on the Coagulation of Ferric Oxide Smokes.** W. CAWOOD & R. WHYTLAW-GRAY, page 1059, Discussion page 1065; **The Movement of Dust or Smoke Particles in a Temperature Gradient.** W. CAWOOD, page 1068; **The Dust-Free Space Surrounding Hot Bodies.** H. H. WATSON, page 1073, Discussion page 1081; **The Determination of Size Distribution in Smokes.** H. S. PATTERSON & W. CAWOOD, page 1084; **The Cohesion between Smoke Particles.** R. STEVENSON BRADLEY, page 1088; **The Size-Frequency of Particles in Mineral Dusts.** H. L. GREEN, page 1091, Discussion page 1098; **The Aggregation of Suspended Particles in Gases by Sonic and Supersonic Waves.** O. BRANDT & E. HIEDEMANN, page 1101; **The Coagulation of Smoke by Supersonic Vibrations.** E. N. DA C. ANDRADE, page 1111; **Experiments on Coagulation by Supersonic Vibrations.** R. C. PARKER, page 1115, Discussion page 1119; **Measurement of the Optical Densities of Smoke Stains on Filter Papers.** A. S. G. HILL, page 1125; **On the Rate of Charging of Droplets by an Ionic Current.** N. FUCHS, I. PETRJANOFF & B. ROTZIEG, page 1131; **An Exact Theory of the Coagulation of Spherical Particles Arising from Thermal Agitation.** W. R. HARPER, page 1139, Discussion page 1145; **The General Properties and Behaviour of Disperse Systems Consisting of Aqueous and Other Volatile Particles, i.e., Mist, Cloud, Hygroscope Nuclei, Town and Country Fogs. Introductory Paper.** G. M. B. DOBSON, page 1149; **The Nucleus in and the Growth of Hygroscopic Droplets.** HILDING KOHLER, page 1152; **The Nature of the Dispersoids in Country and Town Air.** J. H. COSTE, page 1162, Discussion page 1171; **The Determination of the Mass and Size of Atmospheric Condensation Nuclei.** J. J. NOLAN & V. H. GUERRINI, page 1175, Discussion page 1179; **Hygroscopic Nuclei in the Formation of Fog.** JAMES C. PHILIP, page 1182, Discussion page 1184; **Sorption of Fogs by Liquids.** H. REMY, (from experiments with W. SEEMANN, A. PANCERAM & H. FRIEDLAND), page 1185, Discussion page 1190; **Fog Along the Meuse Valley.** J. FIRKET, page 1192, Discussion page 1196; **Sulphuric Acid as a Disperse Phase in Town Air.** J. H. COSTE & G. B. COURTIER, page 1198, Discussion page 1201; **The Influence of Urban Conditions on the Circulation of Electricity through the Atmosphere.** F. J. W. WHIPPLE, page 1203; **On Sulphuric Acid Mist.** A. DOOLEY & C. F. GOODEVE, page 1209; **The Removal of Mist by Centrifugal Methods.** C. F. GOODEVE, page 1218, Discussion page 1221; **The Industrial Aspects of Disperse Systems in Air and Gases. Introductory Paper.** R. LESSING, page 1223, Discussion page 1232; **Twenty-five Years' Progress in Smoke Abatement.** J. S. OWENS, page 1234, Discussion page 1241; **The Inflammation of Dust Clouds.** R. V. WHEELER, page 1244; **The Spread of Smoke and Gasses from Chimneys.** C. H. BOSANQUET & J. L. PEARSON, page 1249, Discussion page 1263; **The Dissipation of Fog.** D. BRUNT, page 1264, Discussion page 1268; **Variations in the Atmospheric Dust Content Due to Micro-Atmospheric Influences.** ROBERT MELDAU, page 1270, Discussion page 1273; **The Energy Efficiency of Ionisation in Electrical Precipitation.** C. A. MEEK & R. WINSTANLEY LUNT, page 1273; **The Physical Basis of Electrical Gas Purification.** G. MIERDEL & R. SEELIGER, page 1284, Discussion page 1289; **A Commercial Plant for Removal of Smoke and Oxides of Sulphur from Flue Gases.** G. NONHEBEL, page 1291, Discussion, page 1297. PRK (13)

# 14. APPLICATION OF METALS AND ALLOYS

**Metallurgical Problems of Aero Engine Manufacture.** E. R. GADD. *Journal Royal Aeronautical Society,* Vol. 40, Aug. 1936, pages 622-633. The aircraft engine designers' constant striving for low weight/power ratio has inspired metallurgical research (to reduce weights) and chemical studies (to increase power); high anti-knock fuels in themselves have introduced certain corrosion problems for the metallurgist. The properties of metals that the designer may need to know are: Hot and cold tensile and fatigue strengths, density, hardness, thermal expansion and conductivity, resistance to corrosion, oxidation, fretting and warting, creep resistance, resistance to repeated impact stress and susceptibility to internal stress during manufacture. Crankshafts, connecting-rods, highly stressed studs, bolts, etc., requiring high tensile and fatigue strengths and stiffness, must be made of steel; good results are obtained with Ni-Cr steels; nitrided materials offer interesting possibilities. Materials for pistons, cylinder heads, valve seats, valves, crankcases, and valve springs are discussed and their analyses and mechanical properties tabulated. FPP (14)

**Metallurgical Needs of the Glass Industry.** R. D. SMITH. *Metals and Alloys,* Vol. 7, Sept. 1936, pages 217-220; Oct. 1936, pages 263-268. The uses of ferrous and non-ferrous metals and alloys in the handling of hot glass before, during and after forming are described in detail. WLC (14)

## 14a. Non-Ferrous

G. L. CRAIG, SECTION EDITOR

**A Review of Copper Alloys.** M. G. CORSON. *Iron Age,* Vol. 138, Oct. 15, 1936, pages 114-115, 117-118, 120, 122, 124, 126, 144; Oct. 22, pages 29-31, 68. A critical review of the complete Cu-alloy industry, classifying all the alloys, both those rarely used and those in common use. Claims that there is little chance of new Cu-base alloys being developed which will have more desirable characteristics than those already in existence. VSP (14a)

**Silver for Industry and the Arts.** *Canadian Chemistry & Metallurgy,* Vol. 20, Sept. 1936, pages 290, 292. Ag solders and alloys for various industrial uses are briefly discussed. The melting points of the solders range from 1300°-1600° F. and make joints having a tensile strength of 40,000-60,000 lbs./in.$^2$ Due to the ductility of Ag alloys, they have been used to butt weld heavy rods of Cu, brass and other non-ferrous metals prior to pulling them into wire of very fine diam. Ag solders possess corrosion resistance approximately in proportion to the Ag, content. They work well on Cu, brass, Monel metal and other alloys used in the construction of dairy, preserving, canning, laundry and other equipment. Ag alloys are produced in graphite crucibles and are cast in Fe molds. WHB (14a)

**New Uses of Nickel.** *Compressed Air Magazine,* Vol. 41, June 1936, page 5063. Very brief review of trends in utilization of Ni is given. FPP (14a)

**Lead Bronze Bearings for Diesel Engines.** M. MELHUISH. *Gas & Oil Power,* Vol. 31, June 1936, pages 151-152. The bearings in internal combustion engines are badly affected by vibrational resonances. Although bearings lined with Sn-base metals have been successfully used, increasingly greater compressions and higher speeds require a sturdier material. For such heavy loads steel shells lined with Pb bronze are advocated. Bearing design is similar to conventional white metal linings. The lining materials used are (1) binary Cu-Pb mixtures, with Pb between 10 and 45%, and (2) ternary Cu-Pb-Sn mixtures. The presence of the Sn prevents Pb segregation. The 70:30 Cu-Pb has a Brinell hardness of 32-34, while the Cu-Pb-Sn alloy is 42-52 Brinell. As the adhesion of the Pb bronze to the shell results from surface alloying with the steel, the latter must be heated to a high temperature. Special fluxes and atmospheres are therefore necessary to prevent oxidation of the steel. Specifications for crankshafts to be used with Cu-Pb alloys, oil clearances required, and the advantages and disadvantages of Pb bronze bearings are discussed. FPP (14a)

**Economies in Use of Die Castings.** *Steel,* Vol. 99, July 27, 1936, page 54. Use of about 20 Zn alloy die castings in an addressing machine improved appearance, reduced size and weight of operating parts, and lowered machining and assembly costs. MS (14a)

**Recent Advances in Bearing Practice.** A. P. BALE. *Power & Works Engineer,* Vol. 31, June 1936, pages 219-222. A brief review is presented of new materials and designs from the mechanical engineer's viewpoint. Rubber bearings are suitable for limited-oscillation applications, such as shock absorbers, motor brush-holder bearings, engine mountings and in textile shuttles. Of less general utility are rubber bearings for rotating shafts, owing to the necessity for an easily available water supply. A new bearing material making great progress is the self-lubricating bearing made from powdered metal. These are applied (a) wherever little lubrication is required and (b) to regulate a gravity supply of oil to journal bearings. Uniformity is essential; a typical compressed product contains Cu, Sn and graphite in the ratio 90: 10: 1-4, possesses a hardness similar to that of high quality cast bronze and can readily be handled and heat-treated after pressing. Automatically adjusted bearings, such as are required for grinding machine heads are also described and illustrated, as are needle and Micarta bearings. FPP (14a)

**Copper Alloys in Industry.** BERTRAM B. CADDLE. *Mining Congress Journal,* Vol. 22, Sept. 1936, pages 71, 78. Reviews briefly the efforts made to harden Cu. Si bronzes are now used extensively in chemical industries and as a construction material. Be-Cu alloys are available in many forms, plate, strip, rods, tubes, and have gained numerous uses during the last decade. BHS (14a)

**New Magnetic Alloy.** *Journal of Scientific Instruments,* Vol. 8, Oct. 1936, pages 336-337. Properties of Alnico, a new magnetic alloy manufactured by General Electric Co. RAW (14a)

**Artistic Bronze Work on New Archives Building.** *Iron Age,* Vol. 138, July 30, 1936, pages 30-32. Describes the ornamental bronze work in the new archives building in Washington. Doors which are said to be the largest bronze doors to be built are 38 ft. high, 1 ft. thick and 9 ft. wide. Each weighs 10,000 lbs. of which 5500 lbs. is bronze and 4500 lbs. is steel. VSP (14a)

**Light Alloys in British Aircraft and Automobile Construction.** *Canadian Chemistry & Metallurgy,* Vol. 20, Nov. 1936, pages 352, 354. A brief discussion of the various types of Al alloys used in aircraft and automobile construction. The chemical compositions of a number of these alloys are tabulated. Wood aircraft propellors are rapidly being replaced by Al alloys. Several applications of Al alloys in the automobile industry are indicated. WHB (14a)

**New Type of Motor-car with Frame Cast in Alpax (La Voiture Grégoire à Carcasse en Alpax)** *Revue de l'Aluminium,* Vol. 13, July-Aug. 1936, pages 257-260. In place of steel-tubes the frame is built up from 5 parts cast in Alpax (Al-Si 87/13 alloy). Mechanical properties of the alloy are:

| | |
|---|---|
| with heat treatment, tensile strength, | 25-28 kg./mm.$^2$ |
| elongation | 2-4% |
| without heat treatment, tensile strength, | 18-20 kg./mm.$^2$ |
| elongation | 4.-6% |

Total weight of light metal 72 kg., total weight of the car 795 kg. HR (14a)

**Fundamentals of Rolling.** N. A. SOBOLEVSKY. *Blast Furnace & Steel Plant,* Vol. 23, Oct. 1935, pages 685-688; Nov. 1935, pages 763-767; Dec. 1935, pages 850-851; Vol. 24, Feb. 1936, pages 149-152; Mar. 1936, pages 236-238, 252; Apr. 1936, pages 313-314, 331; May 1936, pages 413-414, 439-440. Asserts that under normal conditions of sheet rolling, rolled stock does not slide along roll surface. There is no elongation from moment metal is pitched with rolls until it crosses plane of roll centers. Only squeezing of metal in all directions takes place, resulting in widening (spreading), lengthening and thickening behind the rolls (lead), and lengthening and thickening before the rolls (retarding). Metal pressure on roll surface is not always uniform, being minimum at beginning and end of a pitch arc and maximum on neutral plane. Discusses mutual relation of lead, spread, and retarding in all cases of rolling, and explains some rolling problems which have not been understood heretofore. MS (14a)

**Modern Trains in the United States, 1936 (Moderne Züge in den Vereinigten Staaten 1936)** E. ISDAHL. *Aluminium,* Vol. 18, Nov. 1936, pages 552-556. Application of light metals throughout engines and coaches is described and illustrated. Ha (14a)

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## 14b. Ferrous

M. GENSAMER, SECTION EDITOR

**Nickel Alloy Steel Applications.** J. W. SANDS. *Industry & Welding* Vol. 8, June 1936, pages 58-63. Use of Ni steels for weight reduction due to higher strength, for low temperature pressure vessels discussed. WB (14b)

**Progress in Steels for the Petroleum Industry.** L. SANDERSON. *Metallurgia,* Vol. 14, Sept. 1936, pages 147-148. Reviews new types of steels recently used in the petroleum industry. JLG (14b)

**Recent Studies on Alloy Steels and Iron.** FRANCIS B. FOLEY. *Metal Progress,* Vol. 30, Oct. 1936, pages 131-136, 152. Discussion of recent studies reported in 21 references. Such subjects as Al as grain refiner, coalescences of carbides, Ti in steel and Fe, Cu as an alloy, automotive and machinery steels and application of particular steels to special machine parts and electrical sheet steel are covered in the references and author's discussion. WLC (14b)

**Tool Steel. New and Old Studied Intently.** JAMES P. GILL. *Metal Progress,* Vol. 30, Oct. 1936, pages 137-141. Review of recent literature on tool steel. 19 references. WLC (14b)

**Venetian Blinds of Steel—Adjustable in Width, Finished before Forming.** R. L. HARTFORD. *Steel,* Vol. 99, Aug 24, 1936, pages 37-38. Blinds are of 32-gage steel coated with flexible lacquer before fabrication. Slats are pressed in 2 pieces, 1 fitting inside other. Can be used on any window or door from 26 to 40 in. wide. Smallest size blind weighs 2 lbs. more than wood blind of equal size. MS (14b)

**Stainless Steel Broadens Its Market.** CURTIS C. SNYDER. *Iron Age,* Vol. 138, Oct. 1, 1936, pages 30-35. Deals with the rapid rise of stainless steel tonnage the past several years, and considers the various applications of stainless steel products. VSP (14b)

**Reliance Placed on Well Designed, Properly Made Steel Castings for the Good Ship "Queen Mary."** R. A. BULL. *Iron Age,* Vol. 138, Nov. 5, 1936, pages 42-46, 134. Describes the various applications of steel castings in the construction of the Queen Mary. VSP (14b)

**A Monument to Cast Iron.** LEROY W. ALLISON. *Iron Age,* Vol. 138, Nov. 19, 1936, pages 44-45, 122. Describes the cast Fe dome of the National Capitol building at Washington. According to records, the columns, ribs, plates and other cast Fe members, including ornaments, totaled 8,878,743 lbs. There have been no replacements in the basic cast Fe material in its 72 yrs. of existence. VSP (14b)

**Nickel-Alloy Magnets.** A. B. EVEREST. *Electrical Review,* Vol. 119, Aug 28, 1936, pages 273-274. Deals with magnetic properties and applications of steels containing Ni and Al, particularly "Alnico," which contains 20% Ni, 10% Al, and 10% Co. Offers greater magnetic energy per unit volume or weight than any other steel for relatively small cost. Magnets must be specially designed to obtain best results. Honda alloys containing 15-35% Co, 10-25% Ni, and 8-25% Ti, with or without Al, have much better magnetic properties than other steels, but are expensive and have been used little commercially. MS (14b)

**Manufacture of Ford Camshafts. How Metallurgical Control is Achieved.** EDWIN F. CONE. *Metals and Alloys,* Vol. 7, Nov. 1936, pages 275-277. Describes cast Fe, C 3.3-3.65%, Mn 0.15-0.35%, Si 0.45-0.55%, Cr to 0.25%, Cu 2.50-3.0%, P 0.05% max. and the controls applied in the production of this Fe for camshafts. WLC (14b)

**Writing a New Saga of the Roads.** N. C. WOLFE. *Industry and Welding. Third Quarter,* 1936, pages 89-91. Automobile trailer evolution detailed to 1936. Steel and wood construction now used may change to all steel in near future. WB (14b)

**Hollow Sectional Poles.** *Electrical Review,* Vol. 119, Aug. 21, 1936, page 247. Describes "Adastra" poles for use as lamp standards and for carrying overhead lines. They are made of sheet steel, electrically welded into oval tapering sections, which telescope. Sections are galvanized for protection against corrosion. MS (14b)

**More Steel for Boulder Dam.** *Iron Age,* Vol. 138, July 30, 1936, pages 32-33. Discusses the 72", 60-ton needle valves being made by Thomas Spacing Machine Co., Pittsburgh. 570 tons of steel and 150 tons of bronze will be used in the 12 valves. 2 main housings for each valve account for about 75,000 tons of steel. 540 bolts and studs are used in joining 125 parts of each valve. VSP (14b)

**Bath Tubs Promise Steel Outlet.** *Iron Age,* Vol. 138, Nov. 26, 1936, pages 32-35. Pressed steel bath tubs are at present made from 12-gage enameling sheets in standard sizes 60 in. long, 30 in. wide and 18 in. deep. Describes methods of manufacture by the Alliance Porcelain Products Co. and the Briggs Mfg. Co. It is estimated that 300,000 tons of sheets a year would be required if all bath room and kitchen equipment were made of steel instead of cast Fe. VSP (14b)

**The Properties and Applications of Heat Treated Wrought Nickel Alloy Steels.** *Bulletin P-1 of the International Nickel Co., Inc.,* 1936, 14 pages. A discussion of oil and water hardening steels and case-hardening steels with related properties and recommended application is given. Supplemented by informative mechanical property charts of numerous Ni alloy steels. ROS (14b)

**Welded Alloy Steel Plate Used for Subway Car Truck Frames, Bolsters.** *Steel,* Vol. 99, Aug. 24, 1936, pages 34-36, 58. Deals with design of trucks for cars of the Brooklyn-Manhattan Transit Corp. Welded truck frames are composed of pressed plate members of Cromansil, generally ¼" thick, and electric furnace castings of same composition. Design stress of 24,000 lbs./in.² was used. MS (14b)

**Stainless Steel Invades Laboratory.** *Chemical and Metallurgical Engineering,* Vol. 43, Sept. 1936, page 491. Photographs are given showing the use of 18-8 stainless steel on work tables, hoods, furnace jackets, flues and other fixtures in the new analytical laboratory of the Ford Motor Co.'s River Rouge plant. PRK (14b)

**Stainless Steels.** *Chemical Trade Journal & Chemical Engineer,* Vol. 99, Aug. 14, 1936, pages 124-125. Deals with their application in the chemical industries, particularly with overcoming of early difficulties. Austenitic steels are more widely used than plain Cr steels. "Weld decay" has been eliminated by adding W, Ti, Si, and Cb. Austenitic steels containing 3% Mo have been developed for resisting action of acetic acid. Machining has been made easier by holding work perfectly rigid and by use of high-speed steels and specially designed tools. MS (14b)

# 15. GENERAL

**Some Forms of Automatic Regulators.** EZER GRIFFITHS. *Chemistry & Industry,* Vol. 55, Dec. 4, 1936, pages 974-977. A complete description of regulating devices for the automatic control of temperature, pressure, voltage, humidity, etc. AAA (15)

**Titanium and Its More Useful Compounds.** ROBERT M. MCKINNEY & WILLARD H. MADSON. *Journal of Chemical Education,* Vol. 13, Apr. 1936, pages 155-159. History and occurrence of Ti are briefly outlined. Some important methods for the detection and the quantitative determination of Ti are given, together with their limitation. Recent commercial developments of Ti substances are surveyed, with special attention to their production; some of the more important materials being titanous sulphate, Ti tetrachloride, Ti dioxide, and Ti alloys. 6 references. GTM (15)

**University Training in Metallurgy.** *Engineer,* Vol. 161, May 22, 1936, page 564. Modern metallurgical courses owe their inception to the drift of older type of mining engineer towards supervision of purely mining and mineral dressing aspects of metal extraction, and consequent drift of chemist away from analytical work to control of smelting and refining. This new branch of metallurgy is known as "Physical Metallurgy" as opposed to older study of process metallurgy. It has grown beyond all recognition until today it is of the greatest importance embracing all phases of nature and behavior of metals subsequent to smelting. Success of university training is judged by the relation it bears to modern industrial practice, by means of contact maintained with best and most advanced manufacturing technique. Judged from above standards majority of courses fall short of the ideal. Considers metallurgical courses at the universities of Sheffield and Birmingham as having sound educational methods in teaching of metallurgy. VSP (15)

**Sixth Report of the Committee on Atomic Weights, of the International Chemical Union (Sechster Bericht der Atomgewichtskommission der Internationalen Union für Chemie)** G. P. BAXTER, O. HÖNIGSCHMIDT & P. LEBEAU. *Berichte der deutschen Chemischen Gesellschaft,* Vol. 69A, Mar. 4, 1936, pages 25-38. In the 12 months between Sept. 1934 and Sept. 1935, 3 official changes were made in the table of atomic weights. The value for Ta was changed from 181.4 to 180.88 and that for Ra from 225.97 to 226.05. The atomic weight of protactinium, 231, appears in the table for the first time. FPP (15)

**Rock Island Arsenal Laboratory.** L. S. FLETCHER. *Army Ordnance,* Vol. 17, July-Aug. 1936, pages 30-32. The new and improved laboratory comprises complete equipment for tensile, impact, and corrosion tests; a chemical laboratory; and modern metallographic, radiographic, and X-ray diffraction apparatus. The radiographic equipment is operated at 300 KV and 10 milli.-amp. The X-ray diffraction apparatus is rated at 85 KV. DJM (15)

**Inland Expands Indiana Harbor Plant.** ROGERS A. FISKE. *Iron Age,* Vol. 138, Dec. 3, 1936, pages 52-57. Describes the 4 open-hearth furnaces, 9 soaking pits and a blooming mill installed by the Inland Steeel Co. at its Indiana Harbor plant. VSP (15)

**"The Bloody" Battle of the Metals.** S. K. COLBY. *Iron Age,* Vol. 138, Oct. 1, 1936, pages 38-40. The importance and usefulness of competition in the metal industries with special reference to Al is discussed. The real "battle of the metals" goes on far behind the sales lines, in the research laboratories, and plans are focused on distant objectives. New uses are being developed for all of the metals, to compensate for uses in which they are losing out. VSP (15)

**Trends and Methods in Foundry and Machine Shop Accounting.** GEORGE V. LANG. *Iron Age,* Vol. 138, July 9, 1936, pages 56-59. Abstract of address delivered before the Pittsburgh chapter, National Association of Cost Accountants, May 20, 1936. Discusses method of procedure and includes a chart showing method of arriving at normal machine tool cost rates. VSP (15)

**Instruments Are Eyes, Ears and Hands of Steelmaking.** A. F. MORANTY. *Steel,* Vol. 99, Sept. 14, 1936, pages 40-42, 44, 45. Outlines uses of indicating, recording, and controlling instruments in the production of Fe and steel, from raw materials on through blast furnace, steelmaking processes, and various types of rolling mills. Considers also auxiliary applications. Flow-sheet indicates where various types of instruments are being used. MS (15)

**The New German Patent and Trade Mark Law (Das neue deutsche Patent- und Gebrauchsmuster-Gesetz)** L. WEBER. *Stahl und Eisen,* Vol. 56, June 4, 1936, pages 649-654. A brief account of the main points in the new laws and changes from the old. SE (15)

**The Making and Shaping of Alloy Constructional Steels.** E. C. SMITH. *Bulletin F-1 of the Internatonal Nickel Co., Inc.,* 1936, 11 pages. Reprinted from *Nickel Alloy Steels,* and assembled and edited by H. J. French and J. W. Sands, this informative bulletin describes the processing of alloy steels from the furnace through the hot working and inspection period. ROS (15)

**Physical Metallurgy: I.—Recent Developments; II.—Diagnosis of Mechanical Failures.** GORDON SPROULE. *Transactions Canadian Institute Mining & Metallurgy,* 1936 (in *Canadian Mining & Metallurgical Bulletin* No. 289, May 1936) pages 257-277. Recent developments in physical metallurgy are reviewed and the application of metallographic diagnosis to typical mechanical failures is discussed. AHE (15)

**Some Aspects of Steel Chemistry.** JOHN JOHNSTON. *Industrial & Engineering Chemistry,* Vol. 28, Dec. 1936, pages 1417-1423. Presented before the General Meeting at the 92d Meeting of the American Chemical Society, Pittsburgh, Sept. 1936. Presents some of the aspects of the chemistry of steel that are novel and interesting to chemists, giving the high lights only and what the author terms the "chemical philosophy" underlying the properties and behavior of steel. The treatment covers the following topics: Steel-making processes, nature of steel, influence of transformation temperature on final structure, effect of austenite grain size, and effect of alloying elements upon rate of transformation. Curves and photomicrographs illustrate the topics. MEH (15)

**The Manufacture of Wire Springs.** S. W. ROCKEFELLER, JR. *Wire and Wire Products,* Vol. 11, Dec. 1936, pages 705-708. Methods of manufacture, including selection of correct material, heat-treating and finishing of the springs, are discussed. Ha (15)

## 15a. Economic

**Cost Rise Outstrips Prices.** W. W. ROSE. *Foundry,* Vol. 64, Sept. 1936, pages 27, 76. Statistical study of the gray Fe foundries and what they pay for raw materials. This survey was conducted by the Gray Iron Founders' Society with the cooperation of about 200 foundries. Includes tables showing % of increase in local prices, 1933-1935, of commodities used in gray Fe foundries. VSP (15a)

**Chemical and Metallurgical Industries in India.** E. SPENCER. *The Industrial Chemist,* Vol. 12, June 1936, pages 254-256. An account of the various chemical and metallurgical industries. Production and consumption data are given. RAW (15a)

**Germany Making Efforts to Expand Metal Production.** SYDNEY B. REDECKER. *Metals,* Vol. 7, Aug. 1936, pages 7-10. Statistics compiled from recent consular reports by the author to Dept. of Commerce indicate that marked improvement in the metals industry during 1935 has continued during 1936. Figures for first 5 mos. of 1936 indicate Zn output to be 10% greater than for the corresponding period of last year; also a 3% increase in Pb production. Cu mines of the country have been kept in operation due to government backing. Leading the world in Al production with 70,000 tons in 1935, this figure will be even greater this year. Largely as a result of detinning plants, Sn production is also on the upgrade. The increased consumption reflects the high degree of activity in German industry. ROS (15a)

**Mine Production of Gold, Silver, Copper, Lead and Zinc in Arizona in 1935—Final Summary.** C. N. GERRY & PAUL LUFF. *United States Bureau of Mines, Mineral Market Reports* No. M. M. S. 502, Dec. 8, 1936, 4 pages. Statistical. AHE (15a)

**World Markets for Non-Ferrous Metals.** W. R. INGALLS. *Mining Congress Journal,* Vol. 22, Oct. 1936, pages 22-24, 55. A review of market situation for Cu, Pb, and Zn, giving present production, consumption, and stocks. Important changes during the last decade and future trends are discussed. BHS (15a)

**Steel Castings Move Ahead.** RAYMOND L. COLLIER. *Iron Age,* Vol. 138, Sept. 24, 1936, pages 26-27. Contrary to general opinion that welded structures are replacing castings, the production and sale of steel castings amounted to $53,000,000 in 1935; employed 40 billion man-hrs. of labor representing 24,000 employees. Steel castings are being used in critically stressed members under dynamic load exist. VSP (15a)

**A Consideration of Ethiopian Geology (Allgemeines und Geologisches aus Abessinien)** J. KUNTZ. *Metall und Erz,* Vol. 33, Feb. 2, 1936, pages 89-93. Relation between Ethiopia's mineral and ore deposits (with particular reference to Au) and the international political situation discussed. FPP (15a)

**Mine Production of Gold, Silver, Copper, Lead and Zinc in Montana in 1935—Final Summary.** THOMAS H. MILLER. U. S. Bureau of Mines, *Mineral Market Reports No. M. M. S. 494,* Oct. 20, 1936, 6 pages. Statistical. AHE (15a)

**Some of the World's Little-known Platinum Deposits( Ueber einige wenig bekannte Platinvorkommen der Welt)** F. HERMANN & O. GUNTHER. *Metall und Erz,* Vol. 33, Mar. 1, 1936, pages 113-116. The Pt deposits of Ethiopia, British West-Africa, Chile and Brazil discussed. Ethiopian Pt production amounted to 230 kg. 1930. FPP (15a)

**Consumption of Ferrous Scrap and Pig Iron in 1935. Annual Figures.** RICHARD J. LUND & H. W. DAVIS. U. S. Bureau of Mines, *Mineral Market Reports, No. M. M. S. 498,* Nov. 25, 1936, 2 pages. Statistical. AHE (15a)

**Mine Production of Gold, Silver, Copper and Lead in Oregon in 1935—Final Annual Figures.** CHARLES W. MERRILL. U. S. Bureau of Mines, *Mineral Market Reports No. M. M. S. 495,* Nov. 3, 1936, 2 pages. Statistical. AHE (15a)

**The Scientific Organization of Works.** PIERRE CHEVENARD. *Journal Institute of Metals,* Vol. 59, Sept. 1936, pages 435-467 (Advance Copy No. 746). The 15th Autumn Lecture to the Institute of Metals. Discusses technological control and research work in metallurgical plants. The organization and work done at Societe de Commentry, Fourchambault et Decazeville, described. JLG (15a)

**Role of the Fabricator in Developing Stainless Steel Market.** J. C. C. HOLDING. *Iron Age,* Vol. 138, Nov. 5, 1936, pages 53-54, 134. Stresses the importance of the fabricator in the development, and the ultimate consumer acceptance, of new products with special reference to stainless steel. Estimated tonnage for 1936 is approximately 100,000 tons. Considers the development of the industry from the invention of stainless steel by Harry Brearley in 1916 to the present time. VSP (15a)

**Rustless Steels—Production for 1935 Establishes New Record; Expiring Patents May Disorganize Markets.** T. W. LIPPERT. *Iron Age,* Vol. 137, Apr. 23, 1936, pages 22-27, 99. Cr and Cr-Ni alloy steel ingots advanced to 67,227 net tons in 1935, which is 54% increase over 1934 and 23% increase over 1930. Some price disorganization may occur by 1937 due to expiration of certain basic patents controlled by Chemical Foundation, Inc., and American Stainless Steel Co. The survey includes production of both high and low C-Cr and Cr-Ni steel ingots and finished products. Includes tables giving production of corrosion and heat-resisting steels in the United States, 1929-1935, and product and analysis breakdown for 1935 production of corrosion-resisting alloy steels. Several patents are pending which cover the use of Ti, V, Cb and Ta in the analysis of corrosion-resisting steels. The immediate outlook shows little chance of reduction due to high cost of stainless steel. VSP (15a)

## 15b. Historical

**The Technical Application of Copper-arsenic Alloys in Ancient Times (Die technische Verwendung von Kupfer-Arsen Legierungen im Altertum)** WILHELM WITTER. *Metall und Erz,* Vol. 33, Mar. 1, 1936, pages 118-120. As long ago as 4000 yrs., high As Cu was usefully employed by natives of Egypt, Central Germany, and (somewhat later) in South America. The chemical compositions of some of these ancient tools and weapons are compared with those of modern Cu-As alloys scientifically developed, and the ranges of As content shown to be similar. FPP (15b)

**Treatment of Metals Through the Ages.** S. NEIL GREENWOOD. *Heat Treating & Forging,* Vol. 22, July 1936, pages 335-339. Paper presented before Metals Treatment Society of Victoria, Apr. 1936. Traces development of metal treating from earliest times to the present. It is probable that North American Indians and Aztecs hardened Cu by cold working and softened it by heating. Aztecs melted and cast metals. Incas were able to smelt ores and make alloys of Cu and Sn. Relics found at Ur of Chaldees indicate that 6000 yrs. ago these people were able to alloy Au and Ag (electrum), developed casting to a fine art, soldered, and did fine ornamental gold work. Meteoric Fe was used in ancient Egypt, and by 1200 B.C. case-hardening was developed there. Mechanical means of working metals were introduced in Europe in 15th century, making handling of Fe much easier. Heavy steel industry was introduced with the Bessemer process. During past 50 yrs. we have learned about relation between heat treatment and structure and physical properties of metals and alloys, corrosion resistance, and age hardening. MS (15b)

**History of the Oxy-Acetylene Industry in America. Part I.** ERNEST D. FINDLAY. *The Welding Engineer,* Vol. 21, Oct. 1936, pages 25-30. Review of start and rise of the industry and personalities involved. WB (15b)

**Canadian Metal Mining Progress in the Past Twenty-five Years.** CHARLES G. WILLIAMS. *Metals,* Vol. 7, Oct. 1936, pages 15-17. A brief survey of the history and trends of Canada's metal mining progress during the past 25 yrs. is given. Non-ferrous production has increased as follows:

| | 1910 | 1935 |
|---|---|---|
| Copper (lb.) | 55,692,369 | 419,874,920 |
| Gold (oz.) | 493,707 | 3,289,121 |
| Lead (lb.) | 32,897,508 | 339,089,296 |
| Nickel (lb.) | 37,271,033 | 138,516,240 |
| Silver (oz.) | 32,869,264 | 16,624,426 |
| Zinc (tons of ore) | 5,063 | 320,558,659 |

Metallurgical research and advances are given credit for much of the increase. ROS (15b)

**Recalling Century-Old Blast Furnace in Northern Ohio.** FRED B. JACOBS. *Steel,* Vol. 99, Aug. 17, 1936, page 60. Deals with the Arcola blast-furnace near Madison, O. It was a charcoal furnace producing pig-Fe and castings from bog Fe ore. Blast was created by bellows worked by water-wheels in an adjacent stream. MS (15b)

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POSITION WANTED—INDUSTRIAL METALLURGIST available January 1, 1937. College graduate, eleven years of practical industrial metallurgical experience in founding, semi-steel and gray iron castings up to eight tons, brass castings up to four tons. Experienced in supervision of men and electric furnaces, alloying and analysing and initiating costs sheets. Applicant 34 years of age, married. Box MA-20, METALS & ALLOYS, 330 W. 42nd St., New York.

METALLURGIST WANTED. Young man, preferably with some practical experience or training in non-ferrous metallurgy—particularly lead alloys—qualified and interested in both shop practice and development work. Location in middle west. Apply giving full particulars. Box MA-21, METALS & ALLOYS, 330 W. 42nd St., New York.

WANTED: Man with some experience in the construction of industrial furnaces to take charge of shop and to supervise installation in the field. Give all details and salary expected in first letter. Box MA-22, METALS & ALLOYS, 330 W. 42nd St., New York.

WANTED: Pyrometer Man for sales, or sales and service. Middlewestern territory. Salary or drawing account. Fine opportunity with growing organization. Box MA-23, METALS & ALLOYS, 330 W. 42nd St., New York.

SPECTRO-ANALYST, physicist available. Four years' experience with all spectroscopic methods and instruments as well as with photometry and vacuum technics. Married, 32 years of age, no preference to location. Box MA-24, METALS & ALLOYS, 330 W. 42nd St., New York.

POSITION WANTED—Five years gas, electric and thermit welding experience. Demonstrative ability. Knowledge of oxy-acetylene cutting. Experienced on the "board". Two years of College. Married. Age 26. Box MA-26, METALS & ALLOYS, 330 W. 42nd St., New York, N. Y.

WANTED by reputable Mid-Western smelter a representative to sell bronze and brass ingots on liberal commission basis to consumers east of Pittsburgh, including New England states. Must be experienced. State references and qualifications. Box MA-25, METALS & ALLOYS, 330 W. 42nd St., New York, N. Y.

ELECTRO METALLURGIST AVAILABLE: Age 31 (Technical University graduate with best honors) 6 years' experience with all types electric-arc-furnaces for ferro-alloys as assistant-works manager—experienced in laying-out new plants and in technical supervision of production and equipment. Box MA-27, METALS & ALLOYS, 330 W. 42nd St., New York, N. Y.

METALLURGICAL ENGINEER, immediately available. Lehigh U. graduate, age 27. Four years of practical experience. Can initiate and direct research, have worked 1½ years with electrode manufacturer in charge of laboratory. Experienced in heat treating, testing, metallography as well as all types of welding. A-1 references. Box MA-28, METALS & ALLOYS, 330 W. 42nd St., New York, N. Y.

# Book Reviews

## THE METAL IRON. 1st EDITION. H. E. Cleaves & J. G. Thompson.

*McGraw-Hill Book Co., New York, 1935. Cloth, 9¼ x 6 in., 461 pages. Price $6.00.*

The book impressed this reader with (1) the difficulties that beset efforts to secure pure iron; (2) the tremendous amount of effort that has been expended in pushing the accuracy of the determinations of its physical properties to ever greater numbers of decimal places; (3) the fact that these efforts have been the result not of will-o-wisp chasing but of the ever greater dependence of our advancing civilization on that versatile Metal Iron, for a pound of which we may pay 2 cents at one moment and $2000 the next, depending on whether we are buying sash-weights or a new hair-spring for our lady's wrist watch.

The authors present the results of an extensive exploration of the highways and byways of the World's technical literature on the properties of iron, methods of preparing it and of measuring its properties. The broad view they present of an intricate and difficult subject will be of great utility to those who have to deal with iron in a technical way.

At the end of each chapter, the authors present their own critical summary based on the material gathered from the literature, as well as their own extensive investigations. These concise statements of the facts, as they appear to the authors, are valuable both as keys to the abstracted material and as the considered statements of well qualified investigators.

The chapter on the "Thermal Properties of Iron" is interesting. It was startling to note how greatly some of the physical properties of iron are affected by temperature. The specific heat may be changed in a ratio of more than 3 to 1; the expansivity by 13 to 1 and electrical resistivity by 120 to 1. The magnetic properties of specially purified iron are well summarized and the startling effects of impurities, mechanical and other treatments are emphasized by the results brought together.

In the chapter on "Chemical Properties" there is much information that gives a useful sense of proportion to the problem of securing corrosion resistant iron. "Iron rusts," conclude the authors.

In the field of "Mechanical Properties" exact investigations are apparently less numerous than elsewhere, but it was surprising to find no discussion of the "yield point" phenomenon which is such an affliction to many users of iron in its purer commercial forms. The temperamental nature of iron is well shown by the survey of mechanical data, and the results presented will enable future investigators to approach this field with due caution.

Under "Heat Treatment and Aging" are collected much data on the peculiarities of iron that is not quite pure and here again the authors throw into bold relief the great practical importance of small quantities of foreign elements to which so little attention was given in the days before "the damn chemists ruined the steel business."

The material under "The Effects of Minor Constituents" will be of interest to those interested in the development of new iron-base alloys.

The extent of the ground covered by the authors' review, as well as the persistence with which the "pure iron" problem has been besieged, may be judged from the fact that the bibliography (which goes back to 1827) includes approximately 1000 references.

"The Metal Iron" should prove a valuable reference book for those interested in the properties of metals, and the authors and publishers are to be congratulated for having brought forth a valuable and well printed book.—P. H. Brace.

## ANNIVERSARY VOLUME — TO PROF. K. HONDA.

*Science Reports. Tohoku Imperial Univ. Oct. 1936, 1126 pages, 9½ x 11½ in.*

This huge volume commemorates the 25th anniversary of Honda's connection with Tohoku Imperial University at Sendai, Japan, first as professor of physics, then as director of the Research Institute for Metals, and finally as president of the university, his present post. It contains over one hundred separate articles, mostly by former or present students of Honda, with a score by metallurgists of other countries, Bain, Bitter, Kunz and Johnstone, Merica, Lucas and Sauveur, representing the United States.

Other countries are represented by Bauer and Schikorr, Benedicks, Akulov, Borelius, Foëx, Gerlach, Goetz, Hanemann and Jass, Hatfield, Keesom and Van Laer, Körber and Olsen, Osswald, Sauerwald and Schanze, Portevin, Chaudron and Moreau, Siegbahn, Stoner, Smekal, and Westgren.

These distinguished names in metallurgy, physics and magnetism assure the reader of sound articles, though some of them merely repeat or summarize what their authors have said elsewhere. Outside of a few in German and still fewer in French, the articles, including those by the 80 or more Japanese authors, are in English.

A good many of the articles deal with some phase of magnetism, a few with general physics and chemistry, but the bulk are metallurgical. The Japanese authors in general report on specific researches of limited scope, while the others usually handle rather broader topics. Some of the Jap articles are obviously good, some are superficial or mere repetitions of what is already known, and some draw conclusions with which few metallurgists will agree. The English varies from very good to weird, though even at the worst, one can usually tell what the author is trying to say.

When we consider that 25 yrs. ago scientific metallurgy was almost non-existent in Japan, its present status, as shown by the present volume, is a credit to the untiring efforts of Professor Honda, to whom the bulk of that development is directly due. In view of the slight love of official Russia for Japan, that an article by Akulov of Moscow is included in the volume, indicates that the scientists and the generals don't take the same attitude.

A brief biography of Honda, his picture and a list of his publications are included.

Such volumes are always interesting, but the next time such a one is prepared, it should either be held to smaller compass or made into two volumes. This one weighs about 7 lbs., altogether too much for comfortable handling.—H. W. Gillett.

## THE PRESERVATION OF IRON AND STEEL BY MEANS OF PAINT. L. A. Jordan and L. Whitby

*Research Assn. of British Paint, Colour & Varnish Mfgrs. Bulletin 16, not dated. 68 pages., 5½ x 8½ in. Published by the Paint Research Station, Teddington, Middlesex, Eng. Price 2s 10d postpaid.*

A clear summary, written primarily for the paint user. Principles and theories of corrosion are briefly stated. Pigments for priming and finishing coats, media and driers for both are discussed, and bitumen coatings are dealt with. Dip coating of hot steel as it leaves the rolls, or else complete removal of scale before painting are advocated. Pickled and phosphate-coated surfaces are discussed. Composition of steel itself, to be protected by paint, is a factor. Indications of tests now in progress are that copper steels or wrought iron behave better than copper-free steels.

Inhibitive pigments mentioned for priming coats are red lead, lead and zinc chromates, zinc oxide, zinc dust, but some of these are superior to others under certain conditions which are mentioned. More durable finishing pigments are recommended to cover the primers. In preparation of metal surfaces, dryness is a prime requisite. Light sand blasting is good, phosphate coatings ideal bases. Brushing is better than spraying if the latter is done so that moisture is included. Spraying melted paint, without thinner through a blow-pipe flame, is applicable even to damp surfaces.

Lessons drawn from A.S.T.M. and British exposure tests are utilized in discussing principles and practice. Written from a practical viewpoint, concisely and impartially. Bulletins of this class are to be made available to the general public instead of being reserved as confidential to the members of the Association as heretofore.—H. W. Gillett.

## LIBRARIES FOR SCIENTIFIC RESEARCH IN EUROPE AND AMERICA. Philip Spratt.

*Crafton & Co., London, 1936. Cloth, 5½ x 8¾ in., 227 pages. Price 10s. 6d.*

This book is a diary of a trip to many libraries in many countries. The methods used in the libraries visited are briefly reported. The chapter divisions appear a little unusual to the reviewer: Chap. I. Work in the Science Museum Library, 26 pages; Chap. II. Specialized Science Libraries in London, 19 pages; Chap. III. Scientific Documentation in Paris, 19 pages; Chap. IV. Science Libraries on the European Continent, 48 pages; Chap. V. Libraries of Soviet Russia, 15 pages; Chap. VI. Scientific Librarianship in the New World, 89 pages.

The book makes very interesting reading and a copy should be available in every scientific library.—RICHARD RIMBACH.

## THE THEORY OF THE PROPERTIES OF METALS AND ALLOYS. N. F. Mott and H. Jones.

*Oxford University Press, New York, 1936. Cloth, 6¼ x 9½ in., 326 pages. Price $8.00.*

This is one of the International Series of Monographs on Physics. It is an advanced discussion of the modern physical theories of the constitution and behavior of metals and alloys, and considers such subjects as specific heat, the equation of state, superstructures, electron-gas, electrical conductivity, optical properties, cohesion, elastic constants, crystal structure (briefly), and magnetic properties. The quantum theory and the methods of wave mechanics are used freely, and the treatment is generally tersely theoretical. The book has obviously been written for theoretical physicists and should be of little interest to metallurgists.—R. F. MEHL.

## HOW TO FIND METALLURGICAL INFORMATION. Richard Rimbach.

*Published by the author, 1117 Wolfendale St., Pittsburgh, Pa., 1936. Paper, 8¾ x 11¾ in., 32 pages. Price $1.00.*

When we have to deal with a topic with which we are not familiar and need to start from the ground up, we think "I wish there was a good recent book on this particular subject." Maybe there is, and we just don't know about it. This pamphlet, with its author and subject index of metallurgical books, available to August, 1936, will let us know about it. Moreover, it gives concise information on metallurgical handbooks, periodicals, abstracts, services, patents, specifications, buyers' guides, lists of trade names and statistics. It also recognizes the fact that useful metallurgical information is available in company periodicals and in company literature, though the last deals chiefly with book or large pamphlet publications put out by individual firms and could be considerably extended.

The pamphlet will be a boon to technical librarians and to those beginning to search metallurgical literature. Even those who have been steeped in metallurgical literature for years will find that a good deal exists that they are not familiar with and which may hold just the information they want but have not found. It should prove of real utility.—H. W. GILLETT.

## AIRCRAFT TUBING DATA BY SUMMERILL.

*Summerill Tubing Co., Bridgeport, Pa., 1936. 8 x 11 in., 40 pages. Price $1.00.*

Revision of previous edition, including charts for column strength of various sizes and shapes of 4130 X tubing, at various yield strengths. These include high yield strengths which are expected to be employed in the future. A handbook rather than an advertising pamphlet.—H. W. GILLETT.

## TIN PLATE AND TIN CANS IN THE UNITED STATES. B. W. Gonser.

*Bulletin No. 4. International Tin Research & Development Council, Oct. 1936. Paper, 8¼ x 12½ in., 142 pages, 159 figures. Obtainable free on request to the Council, 149 Broadway, New York City.*

The manufacture of black plate for tinning, the tinning process, the manufacture and lithographing of tin cans are all highly mechanized processes operating in a production of huge volume, resulting in a very cheap product. Few people not directly concerned with tin plate or tin can production realize the many details of manufacture and few metallurgists outside those industries could give a very connected story of the metallurgy involved. The tin can is taken too much for granted to be the subject of many papers before technical societies, so not much up-to-date information on it, as a metal product, has been available in the literature.

This monograph traces the production of a can from the ore to the finished product in a clear and readable fashion. While the account is quite complete and authoritative technically, one need not have a technical background to follow the story, especially as the illustrations alone tell nearly as much as the text.

Even were the monograph priced at the usual amount for a book of this size, it would be an asset to the library of any metallurgist. Since it can be had for the asking, we expect that few metallurgists will fail to add it to their shelves.—H. W. GILLETT.

## NICKEL ALLOY STEELS — 1936 REVISIONS TO 1934 EDITION.

*International Nickel Co., New York City.*

Revisions to three sections of this loose leaf handbook have been issued. The section on Properties and Applications of Quenched and Tempered Nickel Alloy Steels has had curves for X3140 added and a few minor changes made. That on Properties of Nickel Alloy Steels at Low Temperatures has been expanded from 16 to 47 pages to include much recent data. The 1935 S.A.E. specifications replace those for 1933. The utility of the handbook is so noteworthy that its users will want to have these additions in their copies.—H. W. GILLETT.

## ELEMENTARY METALLURGY FOR ENGINEERS. 2ND EDITION. G. F. C. Gordon.

*Constable & Co., London, 1936. Cloth, 5¼ x 8 in., 165 pages. Price 8s. 6d.*

This is an entertaining little book, and can be recommended as interesting reading to those ignorant of metallurgy. The teacher searching for an adequate test for engineering students will be disappointed, which is of course not the author's fault, for he makes no claim for it in this respect. Engineers who have had no training in metallurgy should profit by its perusal.—M. GENSAMER.

## THE FABRICATION OF ALUMINUM. *(Die Bearbeitung des Aluminiums)* 2nd EDITION. E. Herrman and E. Zurbrugg.

*Akademische Verlagsgesellschaft, Leipzig, 1936. Paper, 5¼ x 7½ in., 117 pages. Price 4 RM.*

As explained in the preface to this little volume, the principal change in the second edition consists of an extension of the discussion on welding, and particularly electrical methods of welding. Another improvement is the addition on page 110 of a table listing the various alloys with their German trade names according to their type classification, as for example, aluminum-manganese, aluminum-magnesium-manganese, aluminum-magnesium alloys, etc. Otherwise, this edition is much like the first.—JUNIUS D. EDWARDS.

# Current News Items

## C. E. MacQuigg to Be Dean of Engineering of O. S. U.

Charles E. MacQuigg, since 1921 associated with the Union Carbide & Carbon Co., New York, has been made Dean of the College of Engineering of the Ohio State University, Columbus, Ohio. He will assume his new duties July 1. Mr. MacQuigg is an alumnus of O. S. U. having been graduated there in 1909. Following a year's connection with the Santa Fe Railroad, he became identified with the Anaconda Copper Co., as assistant engineer of tests. He then became head of the department of metallurgy of Pennsylvania State College, State College, Pa., where he remained for five years. After service in the World War as an inspector of material in this country, he became associated with the Electro Metallurgical Co., a unit of the Union Carbide & Carbon Co., joining the staff of the Union Carbide & Carbon Research Laboratories. Since 1934 he has been manager of the laboratories.

Mr. MacQuigg is a member of several of the technical societies and is active in numerous important committees, particularly the high temperature joint committee of the A.S.T.M. and the A.S.M.E. His contributions to technical literature have been of a high order. He brings to his new connection a valuable background of both practical and theoretical metallurgical engineering and executive experience.

It's interesting to note that Mr. MacQuigg is the second metallurgist to become the dean of engineering of a large university. The other is Prof. Bradley Stoughton who recently assumed a similar title at Lehigh University, Bethlehem, Pa., where he has been for several years head of the metallurgical department.

## A. E. Gibson Made President of Wellman Co.

Announcement is made of the election of Alfred E. Gibson as president of The Wellman Engineering Co., Cleveland, succeeding George W. Burrell who becomes chairman of the board. Mr. Gibson first worked for the company during summer vacations when in college, and upon his graduation in 1909 from Ohio State University, he entered the employ of the company in its operating department, later becoming superintendent of its Cleveland plant, then general superintendent in charge of both its Cleveland and Akron, Ohio, plants. In 1926 he left Wellman and became associated with the Fulton Foundry & Machine Co., Cleveland, as vice president, later being elected president.

In 1928, upon the election of George W. Burrell as president of The Wellman Engineering Co., Mr. Gibson returned to the Wellman company as its works manager. In 1930 he was elected vice president and in 1931 vice president and assistant general manager in charge of engineering and shop production, and in 1935 was appointed executive vice president. He now becomes its president. The Wellman company, under Mr. Gibson's direction, has widely extended the use of the welding processes and made extensive applications of the new low-alloy, high-strength steels, to its engineered products.

Mr. Gibson is president of the American Welding Society; a member of the American Society of Mechanical Engineers; the Iron & Steel Engineers; the American Society for Metals; the International Acetylene Association, and has made a reputation for himself as an authority on the development and application of low-alloy steels in welded constructions, having appeared on the programs of many societies and technical colleges the last few years.

● Leslie L. Andrus, assistant sales manager of The American Foundry Equipment Co., Mishawaka, Ind., for the past 2 yrs., has been appointed general sales manager in charge of all sales, service and advertising.

## Dr. Cottrell Honored

Dr. Frederick G. Cottrell, Washington, D. C., who perfected the process by which the cost of helium gas was reduced from $1,700 to 10 cents a cu. ft., has been chosen to receive the Washington Award for 1937, according to an announcement in Chicago by Edward J. Mehren, chairman of the Washington Award Commission.

Dr. Cottrell is president of Reseearch Associates, Inc. He is widely known as a chemist and metallurgist, a former director of the U. S. Bureau of Mines and director Fixed Nitrogen Laboratory, U. S. Department of Agriculture. Besides his achievements in the cheap production of helium, Dr. Cottrell is famous for his work in nitrogen fixation, for his processes of cleansing gases of dust and dirt by electrical precipitation and for research in petroleum technology. The award has been made for his "social vision in dedicating to the perpetuation of research the rewards of his achievements in science and engineering."

Dr. Cottrell is the fourteenth noted American engineer to receive this coveted award since it was founded in 1916 by John Watson Alvord of Chicago. The Washington Award is administered by the Western Society of Engineers in cooperation with four other great engineering societies: American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers and the American Institute of Electrical Engineers. Seventeen men, elected for the purpose, compose the Award Commission.

The award is made annually—providing the members of the commission agree on a deserving candidate—as an honor conferred on a brother engineer by his fellows for accomplishment which pre-eminently promotes the happiness, comfort and well-being of humanity. There have been several years when no award was made.

The tangible symbol of the award is a bronze plaque mounted in marble. This was formally presented to Dr. Cottrell at a dinner on February 23.

## Research Laboratory for Bausch & Lomb

At a cost of approximately $40,000 and a 50 per cent increase in its staff of graduate chemical engineers and metallurgists, Bausch & Lomb, Rochester, N. Y., has opened a new laboratory for applied research. "Believing that the optical industry in America will meet increasingly keen competition from abroad where low labor costs exist, Bausch & Lomb will engage in a broad program of fundamental investigations on the chemistry and physics of glass surfaces and in the development of new materials and processes for the industry," says Theodore B. Drescher, vice president, under whose direction the new laboratory has been placed.

Guided by Frank P. Kolb, chief chemist, and Theodore J. Zak, assistant chemist, company officials saw the conversion of nearly 9,000 sq. ft. of space on the fifth floors of two buildings facing the Genesee River into a series of laboratory units devoted to research in the fields of metallurgy, experimental electroplating, spectroscopy, photomicrography, and physical testing. A well-stocked library and a consulting room add to the facilities of the research staff.

● The five-day Conference and Exhibit of New Inventions being planned by the National Inventors Congress will convene in Chicago, March 29 to April 2. Educational meetings will be held in the mornings, and the afternoons and evenings will be devoted to demonstrations of new inventions and new products.

## A. F. A. Nominates Officers and Directors

The nominating committee of the American Foundrymen's Association met in Cleveland, early in February, to prepare and present a slate of officers and directors subject to election at the convention and exhibition to be held in Milwaukee, May 3 to 7. The following were nominated for officers and directors:

For president: Hyman Bornstein, chief chemist and metallurgist, Deere & Co., Moline, Ill.

For vice-president: Marshall Post, vice-president and works manager, Birdsboro Foundry & Machine Co., Birdsboro, Pa.

For directors to serve three terms each:

Duncan P. Forbes, president, Gunite Foundries Corp., Rockford, Ill.

H. B. Hanley, foundry superintendent, American Laundry Machinery Co., Rochester, N. Y.

C. J. P. Hoehn, president, Enterprise Foundry Co., San Francisco, Calif.

Thomas Kaveny, president, Herman Pneumatic Machine Co., Pittsburgh.

C. E. Sims, supervising metallurgist, Battelle Memorial Institute, Columbus, Ohio.

James L. Wick, Jr., president, Falcon Bronze Co., Youngstown, Ohio.

## J. Roxburgh to Present British Exchange Paper

The Institute of British Foundrymen has informed the American Foundrymen's Association that its 1937 exchange paper, which is to be presented at the Milwaukee Convention, will be prepared by J. Roxburgh, president of the Sheffield Branch of the I.B.F. Mr. Roxburgh, who is one of the best known foundrymen of his country, recently was appointed manager of the foundry and pattern shop of Davy Bros., Ltd., Sheffield, manufacturers of rolling mill and steel works plant equipment, hydraulic and forging presses, and general engineers. He was born in Edinburgh and received his technical training from Birmingham University.

After serving his time in the foundries and pattern shop of the British Thomson-Houston Co., Rugby, in 1924, he was appointed assistant foundry manager at the Brightside Foundry & Engineering Co., Newhall Works, Sheffield. Two years later Mr. Roxburgh was made manager of the foundry and pattern shop at the same works. In 1932 he became manager of the foundry and pattern shop, Newton Chambers & Co., Ltd., Thorncliffe Iron Works, Chapeltown, a position which he retained until assuming his present duties with Davy Bros., Ltd.

Mr. Roxburgh is the author of numerous lectures and papers, for which he has been awarded diplomas. He was lecturer on foundry practice and science for two years at Sheffield University evening classes, and is a member of the Sheffield council and the general council of the Institute of British Foundrymen.

## Defiance Pressed Steel Opens New Plant

After an interruption of seven months, the Defiance Pressed Steel Co. resumed manufacturing operations early this year in its new plant at Marion, Ohio, according to an announcement by E. L. Herbolsheimer, president. A long record of 66 yrs. continuous operation was suddenly interrupted last June when a $1,000,000 fire razed the plant then operating in Defiance, Ohio. Immediately following the fire, a new plant site was sought out. This ultimately resulted in taking over the buildings formerly occupied by The Power Mfg. Co., of Marion. Renovizing and rehabilitating work was started within a few days after negotiations were completed.

Rated as one of the oldest pressed steel industries in the country, The Defiance Pressed Steel Co. has specialized in metal stampings of all kinds in the light and medium heavy classifications, and welded assemblies.

● The annual spring meeting of the Electrochemical Society will be held at the Benjamin Franklin Hotel, Philadelphia, April 28-May 1.

## Foundry Conference in East Lansing, Mich.

The fifth annual sectional foundry conference of the American Foundrymen's Association to be held at Michigan State College, East Lansing, Mich., has been scheduled for April 9 and 10. The conference is sponsored by the A.F.A. in cooperation with Michigan State College and the Detroit Chapter of the A.F.A.

This annual meeting, designed to appeal primarily to those connected with gray iron production in the automotive casting field, has established a splendid reputation as an occasion for bringing together leading authorities in the foundry field with discussions on metallurgical and foundry operating problems. The tentative schedule of this meeting follows.

*Friday, April 9*

"Testing of Metals with Particular Regard to Cast Iron," by R. Schneidewind, University of Michigan, Ann Arbor, Mich. Discussion led by Prof. H. L. Daasch, Iowa State College, Ames, Iowa.

"Adaptability of Gray Iron as an Engineering Material." Discussions on *Wear Testing* by:

W. E. Jominy, General Motors Corp., Detroit; S. C. Massari, Assn. of Mfrs. of Chilled Car Wheels, Chicago; P. S. Lane, American Hammered Piston Ring Div., Koppers Co., Baltimore, Md.

Dinner and Entertainment. Chairman, L. G. Korte, Chairman Detroit Chapter, A.F.A. Speaker, C. C. Carlton, Motor Wheel Corp.

*Saturday, April 10*

"Artificial Molding Sands," by Dr. R. A. Smith, Michigan Geological Survey.

"Core Making," by R. E. Aptekar, American Brake Shoe & Foundry Co., New York.

## German Bulletins on Steel Research

The 18th volume of the bulletins of the Kaiser Wilhelm Institute for Iron and Steel Research, in Düsseldorf, Germany, is now complete. As usual, it covers a wide range of chemical, physical, mechanical, and metallurgical research. The following topics, according to Prof. W. Trinks, Carnegie Institute of Technology, Pittsburgh, are included:

No. 1—19 pages
294. Fatigue strength diagrams of steels, with different average tension levels, and for different shapes of test bar.
295. Alternating-stress fatigue limit of steels as a function of the frequency of stress alternation.

No. 2—5 pages
296. A new monochromatic optical pyrometer with calibrating lamp.

No. 3—7 pages
297. X-ray measurements of stresses in quenched steel shafts.
298. X-ray measurements of stresses in welded wide-flanged beams.

No. 4—7 pages
299. Tests on magnetic preparation of low grade iron ore from Lower Silesia.

No. 5—7 pages
300. On the kinetics of the conversion of austenite V (Tests with self-hardening steel).

No. 6—13 pages
301. On the creep of metals subjected to constant tensile stress.

No. 7—23 pages
302. Tests on forces and deformations in drop-hammer forging.

No. 8—20 pages
303. The reactions of molten iron, nickel and manganese with their liquid silicates and solid $SiO_2$ at 2900° F.

No. 9—25 pages
304. The effect of the formation of silicides, phosphides, and carbides in molten iron upon their equilibria with oxides.
305. Reaction heats of nickel-silicon alloys.

No. 10—13 pages
306. On the reactions in the basic open hearth furnace (with particular emphasis on the oxygen contents of steel).

No. 11—14 pages
307. On the magnetic properties of natural and of artificial iron hydroxides.

The average cost per page is 8c. For those who purchase the whole volume at one time, there is a reduction.

For those who can read German and are interested in iron and steel research, these bulletins constitute enjoyable and profitable reading, and may be purchased from G. E. Stechert & Co., 33 E. 10th Street, New York City.

● Announcement is made of the appointment of J. Harry Warriner as works manager of The Wellman Engineering Co., Cleveland. Mr. Warriner started working for the Wellman company in 1905 as tool-room boy, afterwards serving an apprenticeship as machinist, and later becoming its shop estimator. In 1919 he was placed in charge of production and estimating at the company's Akron, Ohio, plant. In 1925 he returned to Cleveland, having been promoted to the sales department and assigned to special sales work. He served in this position to the time of his recent appointment as works manager.

# Manufacturers' Literature

### Micromax Recorder

A paper model of this recorder shows each unit, inside and out, in true perspective, with chart and record in color. Various types of chart records are shown on the back cover. Die-Out ND (1). Leeds & Northrup, Philadelphia, Pa. (B 257)

### Industrial Furnaces

Oil, gas and electric furnaces are described and illustrated in Catalog No. 6 of the Mahr Manufacturing Co., Minneapolis, Minn. (B 258)

### Industrial Air Cleaning

Bulletin No. 904 discusses the use of electrostatic precipitators for air cleaning. The Pangborn Corp., Hagerstown, Md. (B 259)

### Control System

Bulletin No. 460T describes a coordinated control system for automatically operating all the technical operations and factors of an industrial process. The Bristol Co., Waterbury, Conn. (B 260)

### Burner Equipment

Proved economies from the correct burner equipment are discussed in pamphlet No. SC 79 1-37 of the Surface Combustion Co., Toledo, O. (B 261)

### Solvent Degreasing

Present methods and equipment in solvent degreasing are very different from earlier efforts and this company's booklet describes the modern vapor, immersion and spray machines. Detroit Rex Products Co., Detroit, Mich. (B 262)

### Cast Grid Tank Rheostats

Details of construction of these rheostats for electroplating processes are discussed and illustrated in a pamphlet of the Columbia Electric Mfg. Co., Cleveland, O. (B 263)

### Crimped Coils

Prefinished crimped coils in all standard widths and lengths save manufacturers the plating, polishing and lacquering operations. Steel, zinc, brass and copper are the metals offered. American Nickeloid Co., Peru, Ill. (B 264)

### Monel Metal

Many of the industrial uses of this alloy are discussed in a catalog entitled "Strength Plus—Monel for Mechanical Jobs." Technical data are also included. The International Nickel Co., Inc., New York, N. Y. (B 265)

### Operating Valves

The Ross valves for the control of single and double acting cylinders are of the poppet type which, according to the manufacturer, means simplicity of design, delicacy of control and speed of operation. Ross Operating Valve Co., Detroit, Mich. (B 266)

### Simplified Optical Pyrometer

Catalog No. 70 states that the PYRO optical pyrometer is a rugged instrument, simple in operation and suitable for the requirements of scientific laboratories as well as for heavy duty shop practice. Operation, maintenance and accessories are described. Illustrated.

Bulletin No. 40 describes the PYRO Radiation Tube Rapid Recorder. The Pyrometer Instrument Co., New York, N. Y. (B 267)

### Sheet Metal Testing

Directions for the use of the Erichsen method of testing metal sheet are given in a folder which includes a discussion of the advantages of this method. The Bock Machine Co., Cincinnati, O. (B 268)

### Wrought Copper Alloys

Data on suitability of these alloys for hot and cold forming, welding by different methods and physical properties corresponding to the various alloy compositions at commercial ranges of temperatures are some of the features of a new, illustrated booklet of the Chase Brass & Copper Co., Waterbury, Conn. (B 269)

### The Brackelsberg Furnace

Bulletin No. 197 is devoted to the above subject. How this furnace lowers the cost of quality castings, other important advantages and design and operation are discussed. Whiting Corp., Harvey, Ill. (B 270)

### Ladle Fluxes

The advantages of using fluxes for aluminum, brass, bronze, copper, nickel, iron and special alloys are listed in a leaflet of The Maluminum Co., Indianapolis, Ind. (B 271)

### Wet Patch

The manufacturer claims that excellent results are obtained when P. B. Sillimanite wet patch is used to patch crucible furnaces, electric furnaces, etc., because of its high refractoriness, negligible shrinkage and stubborn resistance to slag attack. The Chas. Taylor Sons Co., Cincinnati, O. (B 272)

### Zinc Alloy Die Castings

This supplement of "A Visual Report of Progress" brings the progress being made in the die casting industry up to date. These photographs were intended as a cross section of die casting ideas. The New Jersey Zinc Co., New York, N. Y. (B 273)

### Carbon Determinator

Construction and operation of the Leco Carbon Determinator are explained in an illustrated booklet which claims that a very accurate determination can be made in 2 min. Laboratory Equipment Corp., St. Joseph, Mich. (B 274)

### A New Motorblower

Type CS Motorblower was designed to meet the needs of the services requiring air at one-pound pressure in volumes from 325 to 3200 cu. ft. per min. Ingersoll-Rand, New York, N. Y. (B 275)

### Motor-Operated Controllers

Relatrol—Type 4D for processes where loads are constant or but moderately variable and the Balancer—Type 3E which applies with equally precise results regardless of load changes, according to the manufacturer, are featured in a booklet of the Automatic Temperature Control Co., Philadelphia, Pa. (B 276)

### Piston Replacement

T-slot piston, cam grinding, Lo-Ex alloys and Alumilite finish are discussed in an attractive pamphlet. Aluminum Co. of America, Pittsburgh, Pa. (B 277)

### Surface Hardening by Induction

The TOCCO Process which, it is claimed, reduces hours of surface-hardening time to seconds and produces a scientifically regulated, exact result, is discussed in an illustrated leaflet of The Ohio Crankshaft Co., Cleveland, O. (B 278)

### Heat and Acid Resisting Castings

Bulletin No. 21 lists the most popular analyses of Standard-Alloy together with safe workable loads at different temperatures. The Standard Alloy Co., Cleveland, O. (B 279)

### Nitralloy and Nitricastiron

Leaflet describing three groups of Nitralloy. It also discusses the special alloy steels classified as "Nitrard" and "Nitricastiron," their nitrided cast irons. The Nitralloy Corp., New York, N. Y. (B 280)

### Adahearth

It is claimed that only the highest grade South African chrome ore is used as the base material in this chemically neutral refractory. Botfield Refractories Co., Philadelphia, Pa. (B 281)

### Rapid Moore Lectromelt Furnaces

Bulletin No. TC describes patented lift and swing-aside-roof type quick top-charge electric melting and refining furnaces. Pittsburgh Lectromelt Furnace Corp., Pittsburgh, Pa. (B 282)

### Aluminum

An attractive booklet "Aluminum in Shopfitting and Display" contains a section devoted to practical points on use and fabrication. Arthur Seligman & Co., Inc., New York, N. Y. (B 283)

### Air Conditioning Lectrodryer

This equipment is designed for dehumidification and not for temperature control. If additional cooling is desired, auxiliary equipment can be used. Pittsburgh Lectrodryer Corp., Pittsburgh, Pa. (B 284)

### Gasifier

A pamphlet devoted to the Stewart gasifier contains the claims that its use reduces fuel costs as much as 75 per cent, produces a true gas of high B.t.u. value and is easier on furnace lining. Chicago Flexible Shaft Co., Chicago, Ill. (B 285)

# MANUFACTURERS' LITERATURE

### High Temperature Insulation

For all types of heated equipment is the subject of an illustrated leaflet issued by Armstrong Cork Products Co., Lancaster, Pa. (B 340)

### Special Atmosphere in the Heat Treatment and Brazing of Metals

A reprint of the above article by C. L. West, Research Engineer, is offered by The Electric Furnace Co., Salem, O. (B 341)

### Controlled Grain Anodes

Seymour Nickel Anodes are homogeneous in grain structure, according to this bulletin. Available shapes are illustrated and useful data are given. The Seymour Manufacturing Co., Seymour, Conn. (B 342)

### 3300 Deg. Super Refractory

An illustrated catalog devoted to "Shamva" Mullite contains information regarding its background, characteristics and uses. Mullite Refractories Co., Shelton, Conn. (B 343)

### Beryllium Copper

Data on properties, heat treatment and fabrication of this copper alloy are given in an illustrated leaflet of The Beryllium Corp. of Penn., Reading, Pa. (B 344)

### Heat Exchanger

Bulletin No. 173 describes the Duriron heat exchanger which is available in the company's corrosion-resisting alloys—Duriron, Durichlor, Durimet, Durco Alloy Steel and Alcumite. Illustrated. Duriron Co., Dayton, O. (B 345)

### Fluxing, Deoxidizing and Hardening Alloys

Ajax alloys (phosphor, copper, phosphor tin, nickel copper, manganese copper and silicon copper) are the subjects of a new leaflet issued by the Ajax Metal Co., Philadelphia, Pa. (B 346)

### Nickel Silver

New 48-page booklet, 8½ x 11 inches, describing this product as manufactured in sheets, strip, wire and rods, and profusely illustrated with the industrial applications of the product. The Riverside Metal Co., Burlington County, Riverside, N. J. (B 347)

### Positive Displacement Blowers

Bulletin 22-B12 discusses the structural features of these blowers. Roots-Connersville Blower Corp., Connersville, Ind. (B 348)

### Spectrometric Equipment

Catalog D-221 is devoted to the above equipment. Basic theory and designs are described as well as the various types of instruments. Illustrated. Bausch & Lomb Optical Co., Rochester, N. Y. (B 349)

### Yoloy

A colorful bulletin summarizes the properties of the above alloy steel and lists the physical properties of two typical steels in the Yoloy series. Youngstown Sheet and Tube Co., Youngstown, O. (B 350)

### Ampco Metal

Engineering data of a general nature are offered in Catalog No. 21. Technical explanations have been written so that the layman may understand them. Ampco Metal, Inc., Milwaukee, Wis. (B 351)

### Turbo-Compressor Data Book

This Data Book No. 107 was prepared to give accurate and brief information on the engineering characteristics of turbo blowers and exhausters. The Spencer Turbine Co., Hartford, Conn. (B 352)

### Meehanite Metal

A specification chart of recommended grades for various service requirements has been issued by the Meehanite Metal Corp., Pittsburgh, Pa. (B 353)

### Finish Baking and Drying Ovens

Ovens for various finishing processes are featured in two new bulletins, pages 101-104 of Section A-5, which have been issued by the Despatch Oven Co., Minneapolis, Minn. (B 354)

### Lead

New methods for making lead pipe and lead sheet are announced by The Andrews Lead Co., Inc., Long Island City, N. Y. (B 355)

### Molybdenum in Steel

Data on different types of molybdenum steels are given in an illustrated booklet of the Climax Molybdenum Co., New York, N. Y. (B 356)

### Automatic Optical Pyrometer

Bulletin No. 91-1, second edition, is devoted to the Brown Optimatic System, an optical pyrometer for measuring surface temperatures of hot materials instantaneously and recording automatically all variations of temperature during the period that the hot body is viewed. The Brown Instrument Co., Philadelphia, Pa. (B 357)

### Combustion Tube Furnaces

Tube furnaces, made in two types—hinged and solid—are described and illustrated in Bulletin HD 1236. Hevi Duty Electric Co., Milwaukee, Wis. (B 358)

### Aerocase

Booklet on this subject. Illustrations, curve charts, tables. American Cyanamid and Chemical Corp., New York, N. Y. (B 359)

### Gas Fired Furnace

The manufacturer of the gas fired Lindberg Cyclone furnace for heating at temperatures from 250 deg. F. to 1400 deg. F. claims that the heating rate is remarkably fast. Lindberg Engineering Co., Chicago, Ill. (B 360)

### Bimetal

A simplified version of its manufacture and the way it works is contained in this pamphlet. W. M. Chace Co., Detroit, Mich. (B 361)

### Electric Furnace

The Sentry Model "Y" which is described in Bulletin 1019 is offered especially for small tools, whether hardened on a production or intermittent basis. The Sentry Co., Foxboro, Mass. (B 362)

### Sonittep Products

This booklet discusses heat loss and its control. The advantages of Sonittep insulating cement and its uses are listed. George F. Pettinos, Inc., Philadelphia, Pa. (B 363)

### Chapmanizing

A pamphlet devoted to Chapmanizing which is a process of hardening low-carbon steel, compares it to nitriding and carburizing. The Chapman Valve Mfg. Co., Indian Orchard, Mass. (B 364 )

### Manganese Steel Products

Bulletin R-1 which contains the statement that this company's rolled manganese steel follows precisely the "Hadfield Formula" also contains an alphabetic list of applications. Manganese Steel Forge Co., Philadelphia, Pa. (B 365)

### Corrosion and Heat Resisting Stainless Steels

This company claims that its materials are manufactured by special processes involving direct reduction of chrome ore and providing a closer metallurgical control than has been obtainable heretofore. Rustless Iron and Steel Corp., Baltimore, Md. (B 366)

### Fuel Gas for Welding and Cutting

An illustrated booklet contains the claim that no other gas can compete with acetylene for welding and cutting when correct oxy-acetylene practice is followed. Air Reduction Sales Co., New York, N. Y. (B 367)

### Repeated Stress Machines

These machines for determining the endurance limits of bar, wire and sheet metals are described in a pamphlet of G. N. Krouse, New Kensington, Pa. (B 368)

### Duraloy

Chrome-nickel and chrome-iron alloy groups with recommended applications are listed in a new pamphlet from this company. Illustrated. Duraloy Company, Pittsburgh, Pa. (B 369)

### Heat and Corrosion Resistant Alloys Heated By Gas

Bulletin C1-A illustrates a number of complex castings made from Q-Alloys which are recommended for pipe fittings, furnace parts, etc. General Alloys Co., South Boston, Mass. (B 370)

### Fuel and Electric Furnaces

Tests, such as are described in an article "A Study of Fuel and Electric Furnaces" show definitely whether proper heat treatment is being obtained at the lowest cost. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. (B 371)

### Hy-Speed Case

This new product which can be used from 900 to 1100 deg. F. on high speed tools or those requiring red hardness at elevated temperatures, is described in a colorful leaflet. A. F. Holden Co., New Haven, Conn. (B 372)

### Electromet Review

This publication, whose purpose is to bring "News and Views of Alloy Steels and Irons" to the reader, contains interesting items. Electro Metallurgical Co., New York, N. Y. (B 373)

### Chain and Belt Conveyors

Bulletin 1-B discusses conveyors for use at high temperature. Michigan Steel Casting Co., Detroit, Mich. (B 374)

# MANUFACTURERS' LITERATURE

### Salt Bath Furnace

The Ajax-Hultgren electrically heated salt bath was designed to meet the metallurgical requirements of liquid heat treating operations. Bulletin 103 lists some of the advantages of the furnace. Ajax Electric Co., Inc., Philadelphia, Pa. (B 375)

### Ferrocarbo

This material containing both silicon and carbon combined in the form of silicon carbide acts as a graphitizer or softener when added to cast iron. Carborundum Co., Niagara Falls, N. Y. (B 376)

### What Scientists Say of Leitz Ultropak

Bulletin No. 17 describes the personal experiences and applications to which Ultropak has been placed by scientific workers in various fields. E. Leitz, Inc., New York, N. Y. (B 377)

### Industrial Products

The 1936 edition of this catalog contains information and recommendations on high and low temperature insulations for every industrial need. Illustrated. Johns-Manville, New York, N. Y. (B 378)

### Multi-Rotary Table

The Wheelabrator multi-rotary table—the airless abrasive method of cleaning fragile or intricate metal parts—is described in Folder No. 33. The American Foundry Equipment Co., Mishawaka, Ind. (B 379)

### Silicon-Chromium-Molybdenum Steels

A booklet devoted to Sicromo 1, 2, 3 and 5 steels, gives the analyses of the steels and discusses the effect of both silicon and chromium on the oxidation resistance of steels in which they are used. The Timken Steel & Tube Co., Canton, Ohio. (B 380)

### Superficial Hardness Tester

Catalog Supplement RS-3 is devoted to this hardness tester, intended exclusively for hardness tests where only very shallow penetration is possible and it is desired to know the hardness of the specimen close to the surface. Wilson Mechanical Instrument Co., New York, N. Y. (B 381)

### Electric Heating Elements

A bulletin from this company is devoted to their electric heating elements and terminal accessories for industrial applications. Globar Div., Carborundum Co., Niagara Falls, N. Y. (B 382)

### Car Hearth Furnaces

Bulletin C-736 is devoted to these furnaces which were designed for uniform heating, sturdy construction and fuel economy. The Philadelphia Drying Machinery Co., Philadelphia, Pa. (B 383)

### TAM Products

Leaflet descriptive of TAM metallurgical alloys. The Titanium Alloy Mfg. Co., Niagara Falls, N. Y. (B 384)

### Alloy Castings

Corrosion-resistant and stainless steel castings are the subject of a new booklet. Chemical and metallurgical properties of these castings are included. Michiana Products Corp., Michigan City, Ind. (B 385)

### Research Microscopes

Microscopes and their accessories are discussed in Catalog M66. Spencer Lens Co., Buffalo, N. Y. (B 386)

### Liquitol

Bulletin A1-16-A deals with the use of Liquitol for iron and steel castings and ingots. Alpha-Lux Co., Inc., New York, N. Y. (B 387)

### MoTung High Speed Steel

An illustrated booklet contains information under these divisions: working and treatment, surface protection, high heat temperatures, drawing temperatures, effect of treatments, etc. Universal Steel Co., Bridgeville, Pa., and Cyclops Steel Co., Titusville, Pa. (B 388)

### Dowmetal Data Book

A new edition, containing especially significant accomplishments in the sections Available Forms and Shop Practice has been published by The Dow Chemical Co., Midland, Mich. (B 389)

### Air Setting Bond for Firebrick

Wal-Set, for bonding firebrick and other refractory materials, is the subject of an illustrated pamphlet. It is claimed that after being subjected to heat Wal-Set literally welds the firebrick together. Wahl Refractory Products Co., Fremont, O. (B 390)

### Braze-Rite Furnace

This furnace, developed principally for brazing sintered carbide cutting tools, provides for localized heat to be applied only to the portion of the tool to be brazed. Firth-Sterling Steel Co., McKeesport, Pa. (B 391)

### Phosphor Bronze

A leaflet lists the sizes in which the company's twelve-inch stock bushing bars are now offered. The Phosphor-Bronze Smelting Co., Philadelphia, Pa. (B 392)

### Hi-Steel

Information concerning chemical composition, physical properties and corrosion resistance of this steel is offered by the Inland Steel Company, Chicago, Ill. (B 393)

### Temperature Control

An all electric automatic control which operates on the radio principle is described in an illustrated leaflet. Wheelco Instruments Co., Chicago, Ill. (B 394)

### Sixteen Sins of the Cleaning Room

Are listed in a circular for convenience in checking on cleaning rooms. Great Lakes Foundry Sand Co., Detroit, Mich. (B 395)

### Thermal Analyzer

Laboratory furnace equipment designed to conduct grain size tests, creep tests, thermocouple calibration, etc. and also for precision heat treatment, is described in a brochure of the Stanley P. Rockwell Co., Chicago, Ill. (B 396)

### Konik

Data on this steel's physical properties, corrosion resistance and working are offered by the Continental Steel Corp., Kokomo, Ind. (B 397)

### Properties of OFHC Copper

An attractive booklet contains reprints of three papers relating to the above subject. United States Metals Refining Co., New York, N. Y. (B 398)

### Extensometer

The Kenyon-Burns Young extensometer is described and illustrated in Bulletin 128. Baldwin-Southwark Corp., Philadelphia, Pa. (B 399)

### Pyrometers

Catalog No. 1101B details the features of the TAG indicating, recording and controlling pyrometers which utilize a beam of light, a mirror galvanometer and a phototube. C. J. Tagliabue Mfg. Co., Brooklyn, N. Y. (B 400)

### Portable Tensile Tester

The manufacturer claims that this tester is a real time and money saver and specimens may be tested accurately even by the inexperienced. Detroit Testing Machine Co., Detroit, Mich. (B 401)

### Mo-W High Speed Steels

Composition, tool performance, heat treatment, operations and difficulties are discussed in a booklet devoted to Mo-Max. The Cleveland Twist Drill Co., Cleveland, O. (B 402)

### Metal Working Products

A pamphlet containing information on this company's rust preventives, cutting oils, metal cleaners, liquid baths, quenching oils, etc., has been issued by E. F. Houghton & Co., Philadelphia, Pa. (B 403)

### Modern Metal Finishing

This bulletin is issued periodically. Besides brief articles, a Questions and Answers department is conducted as a special service for metal treaters. E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. (B 404)

### Electric Furnaces

Catalog No. 23 is devoted to the Ajax-Wyatt electric furnaces. Highest possible thermal efficiency, automatic circulation of metal bath, perfect temperature control and low maintenance costs are claimed as advantages to be obtained from the use of these furnaces. Ajax Electric Furnace Corp., Philadelphia, Pa. (B 405)

### Herculoy

A new 60-page bulletin containing data on this silicon bronze alloy which, according to the manufacturer, possesses the strength of steel and corrosion resistance of copper, has been issued by the Revere Copper and Brass, Inc., New York, N. Y. (B 406)

### Fire Brick

This company's Empire fire brick is the subject of a profusely illustrated booklet in which the three different types—dry press, stiff mud and hand-made—are described. A. P. Green Fire Brick Co., Mexico, Mo. (B 407)

### Speed Case Steels

Data on the three new types of this company's "Speed Case" steel in the higher carbon ranges are offered by The Monarch Steel Co., Indianapolis, Ind. (B 408)

# New Equipment and Materials

## Light Weight, Automatic, Portable Spot-Welding Gun Production Unit

The "Progressive Hydraulic Spot Welding Gun," of the Progressive Welder Co., Detroit, a portable production unit, for assembling sheet metal parts, has many features recommending it for use on high or low production work. The principle of hydraulic actuation, new in portable spot welding, gives many advantages over other methods of gun welding operation. Correct pressure on the parts to be welded being one of the vital factors of good welding, hydraulic pressure makes for the perfect fusion of the metals because of its squeeze type of action. Pneumatic or mechanical pressure gives an instantaneous hammer type of pressure which in comparison to hydraulic "Squeeze Action" does not give as complete fusion of the parts. Then the greater pressure available from the hydraulic booster, and finger tip adjustment now makes possible the welding of the same or different gages of metal with the same facility and results. Hydraulic operation makes a smaller, lighter, and more compact hand welding gun, eliminating all delicate working parts from damage in its operation. Being self-lubricated, another weakness of air or mechanical equipment is eliminated.

The complete unit is readily installed on the production line since only connections to air, water, and electrical supply are necessary to start operation. The overhead mounting of the unit on a swivel type hanger gives a working radius of approximately 12 ft. The light, compact gun and cable assembly allows operation as far as the man can reach without exertion or fatigue. The elimination of dangling loose wires, hoses, and being the lightest weight hand gun, allows this small, compact gun to work in closer quarters than any other portable type.

The hydraulic booster, the heart of the unit, is ruggedly constructed, self-lubricated, and capable of a range of pressures from 0 to 300 lbs. The finger tip control for varying this pressure is claimed an innovation and insures the correct pressure for all working conditions. There are three types of guns available on this unit. Electrical current control by the latest timing devices complete the cycle of the three essentials of good spot welding, namely—pressure, heat, and time control. The elimination of the human element in spot welding has been the goal of the industry, and this completely automatic equipment leaves nothing to chance, it is claimed.

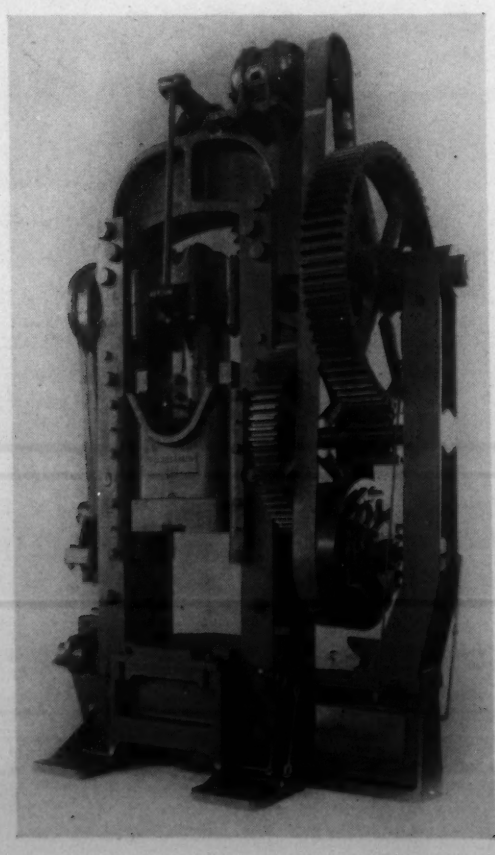
## Instrument for Speed Measurements

A new instrument, the "Standco Normal Rate Hand Tachometer for accurate speed measurements is announced by Herman H. Sticht & Co., 27 Park Place, New York. This instrument is claimed to represent about the most accurate device made for speed measurements. The instrument has a scale graduated into 40 divisions. On the 1000 range, this means that the instrument is arranged for 5 rpm per division and is quite easy to read to 1/5th of a division or 1 rpm in 1000 rpm.

## Crankshaft Trimming Press

A new "300-Ton Double Geared Trimming Press" with air operated clutch has been added to the line of trimming presses made by the Chambersburg Engineering Co., Chambersburg, Pa. This machine has the patented forged steel side frame construction, oversize crank, and outboard bearings which characterize all Chambersburg company trimming press designs.

The new air operated clutch makes the machine extremely easy to control, and this feature automatically provides a safety slip in the event of excessive overload. The reinforced steel sides of the press provide a margin of safety, which makes it impossible to break the frame of this tool. Specifications of the machine are as follows: Frame, "Cecolloy"; stroke, 8 in.; adjustment, 5 in.; bolster thickness, 5 in.; bolster left to right, 37 in.; bolster front to back, 40 in.; ram face left to right, 30 in.; ram face front to back, 30 in.; distance between frames, 40 in.; weight, 68,000 lbs.; single motor drive by 20 hp. constant speed motor.

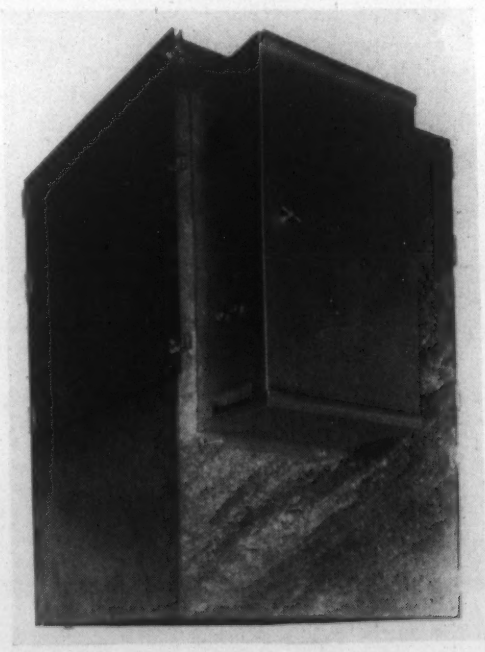


## A New Electrostatic Precipitator

A new electrostatic precipitator for general industral air cleaning use with an operating efficiency as high as 99 per cent by weight is announced by the Pangborn Corp., Hagerstown, Md. The unit is particularly suitable for salvaging valuable dust, mass air cleaning, or removing objectionable particles from gas or vapor and similar applications.

The "Pangborn Electrostatic Precipitator" with electrical parts by Westinghouse has the following claimed advantages:

1. Small size of unit reduces space requirements and cost and permits a complete factory assembled unit. 2. Small vacuum tube power pack attached directly to precipitator cabinet eliminates the usual separate room for high voltage generating equipment. 3. Discharged air does not contain appreciable amounts of ozone nor oxides of nitrogen and may be breathed without irritation of the membrances. 4. May be designed for efficiencies as high as 99 per cent (by weight) and to remove particles as small as one-fifth micron. 5. Operates at lower voltages permitting use of electronic tubes of standard industrial classification and with lower power consumption. 6. Low and constant air flow resistance through the unit resulting in reduced power and uniform air volume.



The illustration represents a unit recently built for a large pottery plant for the removal of excess glaze dust from the air. In general, the complete unit consists of three parts: Collector cells, ionizing assembly, and power pack. These may be furnished assembled in a standard cabinet or as parts for assembly in existing duct work or special cabinets.

## New Wilson Electrode

A new electrode has been announced by the Wilson Welder & Metals Co., 60 East 42nd St., New York. To be known as the "Wilson No. 520", it is claimed that this rod will provide the welding industry with a perfect electrode for use with the small transformer type a.c. arc welders. Striking and maintaining an arc without difficulty is an actual accomplishment with the new No. 520.

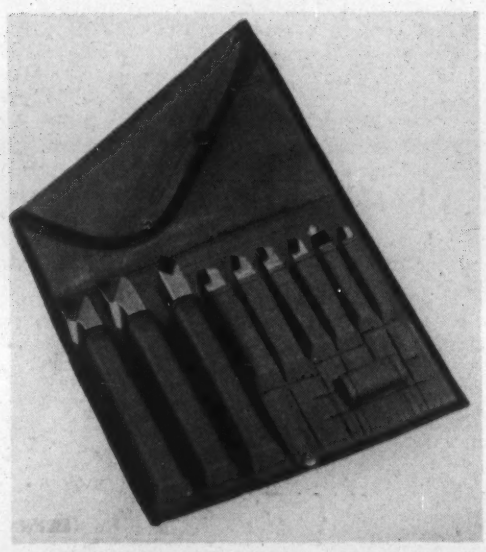
Operators find it exceptionally easy to handle, and that it works equally well with a.c. or d.c. machines. Good-looking bead deposits are the result, and slag interference is reduced to a minimum, with removal simplified.

## General Purpose Carboloy Tool Kit

A new Carboloy tool kit for general machining operations has been announced by Carboloy Co., Inc., Detroit, manufacturers of Carboloy cemented carbide tools, dies and wheel dressers.

The "Carboloy Tool Kit" contains 9 Carboloy tools "milled and brazed", a 20-page booklet showing the new rapid grinding technique, and a 12-page booklet showing more than 50 suggested applications for the nine Carboloy tools. The kit is particularly well adapted for smaller shops whose limited production of any one type of part does not, in many instances, warrant the purchase of single purpose carbide tools. To meet the requirements of such shops, the nine Carboloy tools in the kit are designed for general turning, facing and boring operations on engine lathes, turret lathes, boring mills and boring bars.

The new Carboloy Tool Kit fills a long felt need for an economical means of using carbide on small job lots. Because of its exceptionally low investment cost, $62.58 complete, the average small shop can stock this kit and thereby have available at all times a set of carbide tools ready for immediate use.



## Large Scale Production Of New Magnetic Alloys

The demand for special high strength magnetic alloys—"Alni," "Alnico," and the like —has now increased to a point which has led America's oldest manufacturer of special alloy steel products to begin production operations in a new plant division being utilized exclusively for this purpose. On the basis of successful experience in the manufacture of these alloys on a limited scale, The Taylor-Wharton Iron & Steel Co., High Bridge, N. J., has now put them into regular production in a large scale manufacturing and test routine.

In the newly equipped plant division, quality control facilities for casting, heat treatment and testing to assure greater uniformity of physical and magnetic properties have been extended well beyond previous standards, according to the announcement. As a result, castings of the new alloys will be available to meet strict mechanical and electrical specifications—solid throughout, free from surface defects, and uniform in structure and properties. Magnetic testing equipment of the newest type will be utilized in a rigorous production test routine on the entire output of the new magnets.

While the superior magnetic properties of such alloys have been generally recognized, their use by designers of instruments and other electrical equipment has previously been limited by structural defects and lack of uniformity from magnet to magnet and from batch to batch. Higher standards of control in melting, casting, and heat treatment, made possible by equipment installed specifically for this work, have been found to reduce these production variations to a minimum. Combined with the new testing routine, the new facilities are expected to permit wide expansion in the use of Alni and Alnico in equipment where magnetic properties are critical. Magnet designs heretofore difficult or impossible to cast successfully from the new alloys may also be produced, it is said.

The move of Taylor-Wharton Iron & Steel Co. to begin commercial production of these alloys is regarded as further indirect evidence of the future place in industry of these alloys, as this organization was the first to produce manganese steel and a wide range of other alloys that have since assumed general industrial importance.

## Constant Temperature Laboratory Equipment

The Precision Scientific Co., 1730-54 N. Springfield Ave., Chicago, announces that it is now the sole manufacturers of Freas and Thelco Constant Temperature Laboratory Equipment formerly built and sold by the Freas Thermo-Electric Co. of Irvington, N. J., and Chicago.

All of the good-will, trade-marks, constant temperature laboratory equipment patents, and designs, are now the property of the Precision Scientific Co., having been acquired from the Freas Thermo-Electric Co. with whom the Precision Scientific Co. was associated since September, 1935.

The names "Freas" and "Thelco" have been retained to identify the added line of constant temperature laboratory equipment now built by the Precision company, because such trade-marked names symbolize dependable performance, having gained their reputation over a period of 30 yrs., since the original design by Dr. Thomas B. Freas at the University of Chicago in 1907. To proven basic fundamentals of Freas and Thelco design, the Precision Scientific Co. has added its own strong technical resources.

**The performance of Standard Alloy castings made and installed by us in walking beam furnaces eight and nine years ago is your assurance that you can rely upon Standard facilities, engineering, foundry practice and experience for replacement parts. May we speak now for that business? . . Remember, we specialize in nickel chrome alloy, pouring no other metal.**

*Illustrated—Standard Alloy Walking Beams*

STANDARD ALLOY COMPANY, INC.

1679 Collamer Road — Cleveland, Ohio

STANDARD *Heat-Resisting* CASTINGS

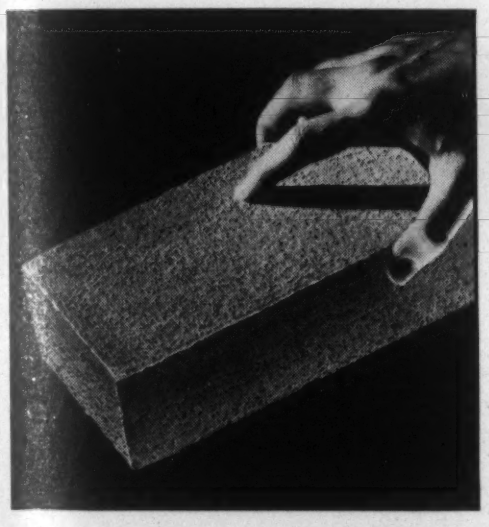
NICKEL CHROME ALLOY

## A New Insulating Brick

Johns-Manville has recently placed on the market a new type of 2000-deg. insulating brick known as "JM-20". This new brick, fully protected by Johns-Manville owned patents, was developed by the company's research laboratories for use behind refractory walls in open-hearth regenerators, in hot blast mains and bustle pipes, in producer gas mains and in various types of furnaces. It can also be used for direct exposure in radiant tube type annealing furnaces, electric furnaces or wherever there is no flame impingement, slag action or mechanical abrasion, at temperatures up to 2000 deg. F.

Research on basic raw materials used in refractory insulations led to the development of JM-20 Insulating Brick. This new type of insulation is produced by combining a high quality refractory clay with a specially manufactured, fibrous, light weight, inorganic aggregate. This brick is unusually light in weight, weighing less than 1.7 lbs. per standard 9-in. equivalent. Its low heat capacity is less than one-quarter that of ordinary refractories—and its thermal conductivity is less than one-sixth that of fire brick.

Data sheets giving full particulars on JM-20 Insulating Brick may be obtained from the company.



## A Heat Indicating Paint

In "Efkalin Paints" the production engineer and the maintenance engineer have a new medium through which they can detect serious deviation in temperature in processing equipment, power machinery transmissions, etc. These paints have the property of changing color when *exposed to heat*. Some Efkalin colors will turn back to original color when cooled; others will remain permanently changed.

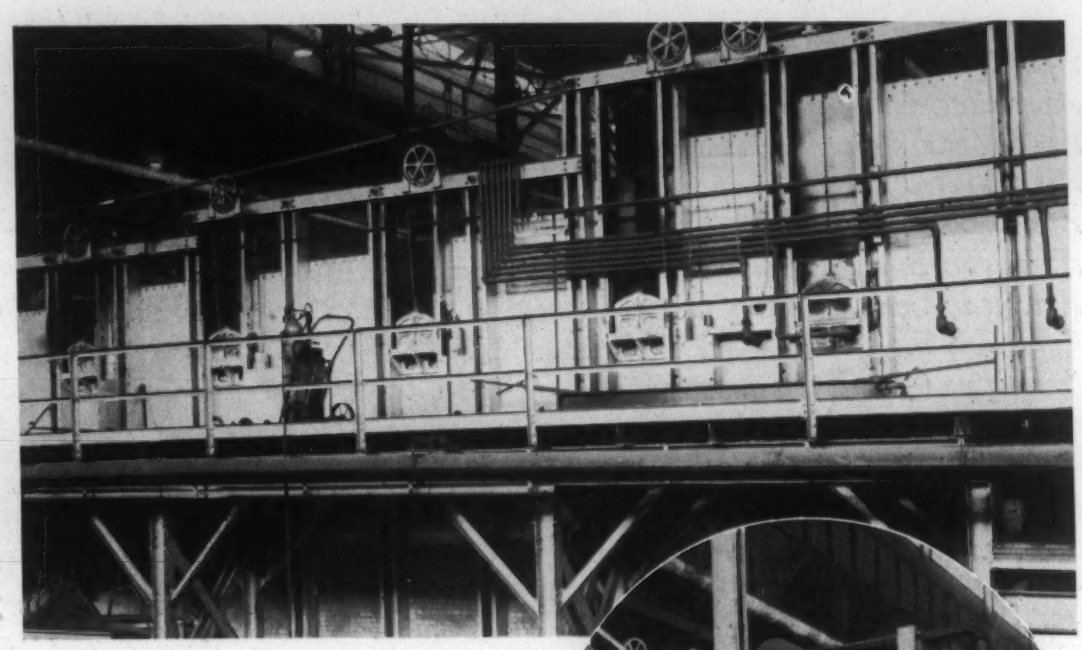
A series of five permanent changes and seven retroactive color paints are available. The former change at temperatures ranging from 300 to 734 deg. F.; the latter from 104 to 464 deg. F. with a safety margin of 25 deg. F. Each of the temperature changes is sharp and wide, leaving no room for doubt or question as to the heat of the object to which it is applied. The Efkalin line is pointed to as cheap insurance *against loss* to production, loss of time of machines and equipment to which it is applied because of its timely warning to operators through its color change. The paint also lends itself readily in productions where heat is used to form a perfect seal, lack of sufficient heat causing rejected articles.

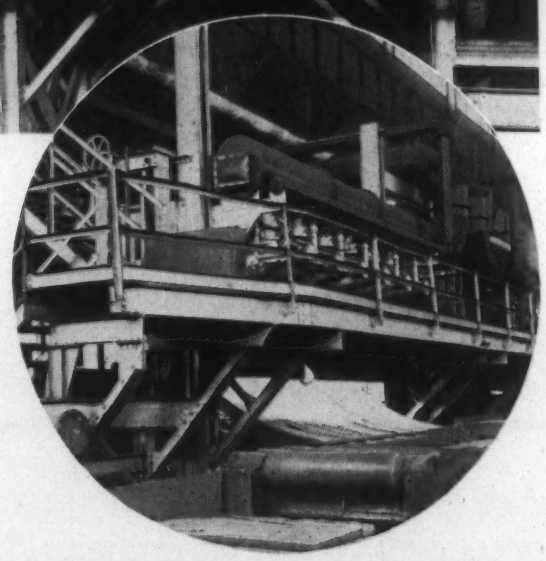
Permanent change Efkalins require re-coating after each change, while the retroactive ones are good for from 25 to 50 changes and, in some instances, for greater number before re-coating. The Efkalin paints are so scientifically compounded and controlled that they do not deteriorate in the package and, if stored according to directions, will keep 12 mos. They are prepared in two types, exterior and interior, which at the present writing, is good for 12 mos. protection of surfaces upon which they are applied. They are produced by the Efkalin Co., 804 East 141st St., New York City.


# ARMSTRONG'S INSULATING FIRE BRICK

## • *Increase Efficiency*
## • *Lower Fuel Costs*

## IN THIS SLAB HEATING FURNACE





***Two views of a new Surface Combustion Slab Heating Furnace, insulated throughout with Armstrong's A-25 and N-16 Insulating Fire Brick***

WHENEVER maximum efficiency and economy are required in a furnace, insulation is a major consideration. That's why so many successful furnace builders and plant supervisors standardize on Armstrong's High Temperature Insulating Fire Brick.

In all types of furnaces, Armstrong's Fire Brick provide more uniform temperatures, greater fuel savings, and more efficient operation. Care and precision in their manufacture assure high crushing strength, freedom from shrinkage, and accurate sizing in every brick.

Armstrong's complete Line of high temperature products includes five types of Insulating Fire Brick for a complete range of temperatures and uses. They can be made up in any special sizes—machined to size with a tolerance of 4/1,000 of an inch, or cast to size with a tolerance of 1/10 of an inch. Write today for samples and descriptive literature. Armstrong Cork Products Co., Building Materials Div., 982 Concord Street, Lancaster, Penna.

# *Armstrong's*
# HIGH TEMPERATURE INSULATION

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